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VIEWS, NEWS AND INTERVIEWS.

A gentleman, well known as a maker of recording gauges, has a little son of an inquiring turn of mind. The other evening the boy said to his father:

"Papa, where is Atoms?"

Father—"Athens, you mean; don't you, my dear?"

Inquiring son—"No. Atoms, the place where people go to when the boiler explodes; because, it always says they were blown to Atoms."

An electrical engineer and inventor, who has devoted considerable time to electric traction matters, spoke this way:

"Many years ago, a college professor propounded to one of his students, a youth from the rural districts, the following question: 'When an irresistible body meets an immovable body, what happens?' Scratching his head to allow of a circulation of ideas amongst the hayseed, the youth replied, 'Sumthin's got ter give.'

"This remark is, in a nutshell, the answer to lots of problems in electric traction. So long as a heavy motor rests dead on an axle subject to gravity (an irresistible force), at the same time provided with inertia proportioned to its weight (an immovable body), just so long will something have to give. Sometimes it's the motor; again it's the rails. This explains why motors fail and rails wear at the ends. Rigidity of structure with a heavy motor wears the rail; rigidity of rail ruins the motor."

A traveler, recently returned from England, says that every electric light station he visited over there was a marvel of neatness. The walls were covered with glazed tiles, and every detail of construction was of a substantial and lasting character. According to the traveler, the English estimate that in establishing an arc lighting plant, the first 50 lights cost £50,000, with a very small fraction added for additional capacity.

"In Berlin, the arc light poles are things of beauty," remarked Mr. Geo. W. Davenport, of the International Thomson-Houston Company. "They are more properly brackets than poles, though. The taps from the mains in the streets are carried under the sidewalk to the house wall and then up to the surface. At the sidewalk begins the handsome iron scroll work affair which runs up the house and then out over the street supporting the arc lamp. Near the base is a panel door provided with lock and key. Back of the panel is a compartment holding the fuse strips and switch, and a handle which fits on the square head of a windlass shaft projecting from one side of the compartment. The lamp trimmer comes along in the morning, unlocks the panel door, examines the fuse strips, throws the switch, takes out the little handle, turns the windlass, lowers, trims and raises the lamp, restores the handle to the compartment, throws down the switch, locks the door, and goes on to the next lamp. All this work has been done without climbing a step.

"The whole device is painted dark green, picked out in gilt. Far from being unsightly, they are real ornaments to a street. The householders are anxious to have these brackets placed on their houses, often paying half the cost, and sometimes the whole cost, for the privilege. These devices are well made and expensive, costing about $150 apiece."

Long Distance Telephone Booths.

The Long Distance telephone booth which has become a feature of all pay stations equipped with Long Distance instruments, both for local telephoning and conversations at a distance, has been manufactured especially for the American Telephone and Telegraph Company, and is now furnished by that company at all the points reached by its lines. It is the result of a large number of experiments in which the object has been to make the place in which the telephone instrument is contained as nearly sound-proof as possible. Experiments were made with draperies, and in various methods of building up a booth, but nothing was found as effective as a complete double booth, which is shown in the engravings. In this the inner booth, which contains the telephone instrument, is entirely separated from the outer, there being an air space of about two inches all around it, and points where contact would be made being protected by rubber buffers. There is a double door, the inner, by link and toggle, being made to open simultaneously with the outer. Upon the windows of the booth may be found the well known blue bell, which is now an indication to the business man in all important parts of the country that the very best kind of a telephone is to be found within.

These booths, placed in hotels, ticket offices, messenger offices, and other points frequented by the public, have proved of great benefit, and many private interviews are held within them, where all around is noise and confusion. Many private business firms have placed booths in their offices, having the telephones inside of them, and are thus able to do their telephoning without interruption from the business going on around them, or without being overheard by people present in their offices.

FIG. 1.—BOOTH USED FOR LONG DISTANCE TELEPHONING.

As the telephone is becoming more and more a medium for important business transactions, interviews and conversations, its surroundings are being constantly improved, and the sound-proof booth may be classed as one of the recent developments.

The annual meeting of the Vermont International Telegraph Company was held at St. Johnsbury, Vt., last week. These officers were re-elected: President, Franklin Fairbanks; secretary, George W. Hendee; superintendent, E. A. Silsby.

RAPID TRANSIT AT THE ELECTRIC CLUB.

An Important Meeting Addressed by Edward Weston, Frank J. Sprague, Louis Sterne and Others.

AN UNDERGROUND ELECTRIC ROAD THE THING FOR NEW YORK CITY.

Although a fierce storm was raging outside, the interior of the Electric Club never presented a handsomer or more animated scene than Thursday evening of last week. The discussion of "Rapid Transit for Cities" had brought the members and their guests together. After enjoying an elaborate and well served dinner, a most entertaining and instructive series of addresses were delivered. The meeting adjourned shortly before 12 o'clock, and even at that late hour every member was still present. This is strong evidence of the interest taken in the subject, as well as of the ability of the speakers to entertain and instruct. Gentlemen present as guests of the Club were: Mr. Edward Weston, Commissioner Heintz and Lieut. Frank J. Sprague, of New York; Mr. Louis Sterne, C. E., of London; Mr. H. H. Neill, editor *Commercial Advertiser;* W. J. Richardson, Secretary American Street Railway Association; Mr. C. E. Emery and Mr. C. O. Mailloux, of New York. Among the Club members present were: President O. E. Madden, T. C. Martin, P. H. Alexander, C. E. Stump, W. L. Candee, Chas. Dutton, H. Ward Leonard, Chas. X. Cordier, N. M. Beach, H. Durant Cheever, E. F. Peck, Frank C. Mason, Geo. T. Manson, E. E. Bartlett, C. D. Shain, H. A. Reed, Jos. Wetzler, W. J. Johnston, Cyrus O. Baker, Jr., S. L. Coles, Dr. Louis Bell, F. R. Colvin, Allen R. Foote, Geo. M. Phelps, H. L. Storke, R. L. Shainwald, C. S. Bradley, J. C. Chamberlain, W. H. Fleming, W. J. Hammer, Herbert Laws Webb.

President Madden announced that the following amendment was to be considered:

Section 2.—Any By-Law may be suspended for a period not exceeding three months by a majority vote of the Active Members present at any regular meeting or adjournment thereof, or by a two-thirds vote of the Active Members present at any special meeting.

On motion the amendment was unanimously adopted, and then Capt. W. L. Candee presented the following resolution, which was adopted:

Resolved, That that portion of the By-Laws which fixes the initiation fees for Active and Associate Members be, and hereby is, suspended for three months, and that new members be admitted during the same period on the payment of one-half of the regular initiation fee.

Chairman Martin, of the Committee on Invitations, then read the letters of regret, Colonel Hain's response being received with much laughter.

The following letters were addressed to

the Committee, composed of Messrs. T. C. Martin, P. H. Alexander and C. E. Stump:

FROM THE MAYOR.

NEW YORK, February 18, 1891.

My Dear Sir—I have the honor to acknowledge the receipt of your communication of February 13th, inviting me to attend the dinner and discussion by the Electric Club of the subject of "Rapid Transit in Cities." I am deeply appreciative of the importance and value of such discussions at this time and I regret exceedingly that my present engagements are so numerous as not to permit of my increasing their number, at least for the present month.

Believe me to be, with much thanks for thoughtful consideration,

Very truly yours, HUGH J. GRANT.

FROM COLONEL HAIN, OF THE ELEVATED RAILROAD.

NEW YORK, February 14, 1891.

I have your kind invitation to be present at a dinner given by the Electric Club, on the 26th inst., and I very much regret that it will be impossible for me to be present on that occasion, and I would prefer not to give my views as to the manner in which I would grapple with the difficulties of the rapidly growing passenger traffic.

Thanking you for the courtesy extended and regretting my inability to be present, I am, Respectfully yours,

F. K. HAIN,
General Manager.

FROM PRESIDENT WATSON OF THE AMERICAN STREET RAILWAY ASSOCIATION.

BUFFALO, February 23, 1891.

Your invitation to attend the dinner at the Electric Club, on the evening of February 26, and to discuss the question of "Rapid Transit for Cities," I found on my return home. I thought, when I saw you in New York a few days ago, I should be able to attend, but now find it impossible to do so, and must, therefore, decline your kind and thoughtful invitation.

Trusting that we may all gather a great deal of information from that meeting, I remain, Yours very truly,

H. M. WATSON.

FROM MR. PEARSON.

BOSTON, February 25, 1891.

Your kind invitation of February 13 is at hand. It would give me much pleasure to attend the meeting, but circumstances are such that it will be impossible for me to be present.

In regard to the question of rapid transit for New York, from what observation I have been able to make in my hurried trips to New York city, I am of the opinion that there are two questions to be dealt with in connection with this subject—first, the transportation of people to and from their homes in the outlying districts; and second, the transportation of people in and about New York city.

The latter might be satisfactorily solved by the use of surface electric cars in place of horse cars, and I see no reason why an overhead trolley system should not work as successfully in New York as in Boston. The streets of New York are much better adapted to the purpose, as they are in most cases considerably wider. In crowded streets no better speed can be maintained with electric than with horse cars; but these are few in number, and in the downtown districts. On all of the avenues north of Twenty-third street, an increased rate of speed could be maintained, thus greatly facilitating business. This would also be true of nearly all lines running east and west.

I am aware that there is a strong feeling in your city, especially with the New York press, against the overhead trolley system, but from my personal experience during the last two years in Boston, I can see no valid reason for the existence of this prejudice. A number of articles bearing on this subject have appeared in the New York papers, which were entirely misleading and grossly misrepresented the condition of affairs and state of public feeling in Boston.

In considering the unsightliness or dangers of overhead wires, the general public does not discriminate between those carrying dangerous currents, or those insecurely supported, and the trolley wires, which are necessarily erected in a substantial manner.

In all the experience of the West End Road since the adoption of electricity, there has not been a single instance of failure in the overhead lines during the storms which have played such havoc with other wires.

Any objection to the appearance of the overhead work would seem rather absurd, inasmuch as the elevated railroad structures are tolerated.

In regard to the accomplishment of the first object, either a tunnel or an overhead viaduct would be necessary. A viaduct would, of course, be much more popular with the community, but would require an enormous expenditure of money to acquire property for its location.

To accommodate the rapidly increasing traffic in New York, probably four trunk lines at least would be necessary, each with four tracks—two for local and two for express service. There are now eight tracks on the elevated lines and, at a moderate estimate, double this number will be needed within the next 25 years. Four viaducts, properly constructed and including the land damages, would require such an enormous expenditure that it would be almost prohibitive.

The other alternative would be to tunnel, and this, I believe is the way in which the rapid transit problem will have to be solved. In this case, I think, the same number of four-track trunk lines would be required, each track preferably in a separate tunnel on account of the lessened cost of construction and the more satisfactory operation,

In my opinion, these tunnels should be as near the surface as practicable, with each station placed on a summit in order that the energy of the train could be partially absorbed in mounting the grade, thus giving a certain potential energy available for overcoming the inertia of the train in starting.

This arrangement of stations on summits would decrease the size of locomotives and the amount of power required in operation. Moreover, the stations being near the surface, elevators could be dispensed with in many cases, the distance necessary for passengers to ascend being no greater than with the present elevated roads.

FIG. 2.—ANOTHER FORM, TELEPHONE SET ON THE SIDE.

With the improved systems of tunneling there is no great object in going far below the surface, as the tunnel could be driven under the surface of the street at a depth just sufficient to avoid gas, water pipes and sewers, without disturbing foundations of buildings and the surface of the street, and by selecting the proper places for stations, the tunnel could be brought within a few feet of the surface at stations.

Elevators might be required in some places, and it might be found advisable to put them in at each station, although the first cost and expense of operating would be important items to be considered.

As regards motive power, whatever system is finally decided upon, there is no question in my mind but that electricity is best adapted to the purpose, and in all probability some form of electric locomotive will be used, inasmuch as the expense of operating and the care of the machinery would be less under these conditions than if motors were put under each car. An overhead trolley system would be the best means of supplying the current to the locomotives, especially if the tunnel is adopted, inasmuch as a rigid contact bar could be erected, and, by placing it overhead, all complications at switches and cross-overs would be avoided. The return current could be carried by the rails and a supplementary conductor under the track, as is now ordinarily done.

The location of the lines and the general system being decided upon, the various problems in connection with the construction and operation, such as location and design of power stations, design of locomotive and distribution of power, would be questions not difficult of solution, and would be readily worked out by the engineers in charge.

Thanking you for your kind invitation, and regretting that it is not possible for me to accept, I am, yours truly,

F. S. PEARSON.

FROM MR. MONKS.

BOSTON, February 25, 1891.

Acknowledging the receipt of your courteous invitation of February 13, to be present at the dinner of your club to be held Thursday evening, February 26, at which the question of "Rapid Transit" is to be discussed, I greatly regret my inability to be present.

The question is, perhaps, the most important one now pressing for solution in all the principal cities of the country. On it hang vital considerations of public health, comfort and happiness, as well as the possibilities respecting the future increase in growth of population, in growth of wealth and the general well being of the community; hence it is a question of the greatest interest to all classes of people. To the capitalist, because its practical solution affords him the opportunity for making profitable investments in lands in the suburbs, of building houses and stores which will meet with a ready sale, and of turning the present country roads and lanes into village streets, bordered by the quiet, retired and happy homes of the great mass of the city's toilers. To the laboring man, because it will afford to him the opportunity to gain for himself a modest and comfortable home, where his children may live and grow up to manhood and womanhood free from the many objections to city life, and where for a small fare he may be transported daily with comfort, safety and speed to and from his work. It would be well nigh impossible to find any one, now a resident of a great city, who has not a vital interest in this question. How shall this highly desirable end be attained? Many interests must be consulted, in order that the scheme may be a united and harmonious whole, and that the greatest good of the greatest number be subserved.

In the first place, capital must be interested. Capital is proverbially timid, and cannot be coaxed into any enterprise unless the reward for the risk of loss can be plainly shown. If the plan proposed involves the expenditure of many millions of dollars, with considerable doubt as to the probabilities respecting net earnings available for dividends, if the company embarked in the enterprise is likely to be met by restrictive or adverse municipal or State interference, capital will surely hesitate or decline to assume the burden and risk of the undertaking. The end to be attained is of that degree of importance to the well being and happiness of the community, that capital should not be frightened off by the probabilities of inadequate returns and a constant fear of municipal and State legislation of an adverse nature, thus crippling the enterprise at its inception. It should not be possible, however, for capital to receive inordinate or extravagant returns, but all investments of actual cash capital should be reasonably sure to receive a just and adequate reward for the risk involved. The company should be freely granted all reasonable and necessary rights, privileges and franchises, to enable it in good faith to carry out fully and completely all its plans in respect to the proper construction and operation of its enterprise, and these having been given, it should be held to the strictest accountability in carrying out all the duties and obligations to the public which they are entitled to receive in return for the right to build and operate the system. The obligations upon the company should be plainly and clearly understood and agreed upon before the work shall be commenced, and these should not be changed afterwards, except under conditions which clearly make such action imperative and absolutely necessary for the public welfare, and at the same time in the strict line of justice to the stockholders of the company. To any one at all familiar with the operation of surface railways occupying the public streets as a road-bed, it is not, perhaps, necessary to state, that "rapid transit" under these conditions is a physical impossibility and that the only practical solution of this question is to be found in one of two methods; to wit, an underground road or a road elevated above the surface of the street or buildings. Each of these plans may be gravely criticized and challenged, but the advantages and disadvantages of both should be carefully and dispassionately weighed. The least possible length of either, which will serve the purpose, should alone be undertaken. By making connections with the surface horse, electric and cable lines, a comparatively short length of elevated or underground road may be made to be a powerful factor for good. Hence, the main line of an elevated or underground road should own or control its surface feeders, to the end that the same management may actuate both, and the public receive the best and largest possible degree of comfort and accommodation which it is possible to give for the fare paid. The act of transfer of passengers from one line of transportation to another is always attended with the greatest difficulties, but it is possible to accomplish such transfer in a satisfactory manner when certain surface conditions are given. Local conditions are, of course, decidedly important factors which should govern the number of elevated or underground roads, their length and points at which transfer may be made to or from the surface lines.

Having given this subject most careful consideration, I am constrained to believe that a four-track elevated road, allowing two tracks for express trains and two tracks for way service, built through the congested part of a city to the suburbs, and connecting there with surface lines radiating from said termini, in such manner that the entire trip on both the elevated and surface lines may be made for one fare, will prove for many years to come a measure of great popular satisfaction, and solve, in many of the large cities, at least, the present riddle of "How shall we get to and from our homes and places of business cheaply and safely?"

Very truly yours,

FRANK H. MONKS.
Gen'l Manager West End Street Railway Co.

FROM MR. MCNAMARA.

ALBANY, N. Y., February 21, 1891.

I acknowledge the receipt of your invitation to be present at a dinner to be given by your club on the 26th inst., at which the subject of rapid transit for cities is to be discussed. I regret exceedingly that it will be impossible for me to be present.

In response to your request to give a brief statement of the manner in which I would personally grapple with the difficulties of rapidly growing passenger traffic, I beg leave to say that since we have discovered that electricity can be used as a means of transmitting power, rapid transit can be assured for all large cities by means of underground railways. Surface railways and elevated railways will always be troubled in this latitude, by snow, sleet and ice, which render communication by means thereof uncertain during the Winter months. Of course, in tunnels no such difficulties will be met.

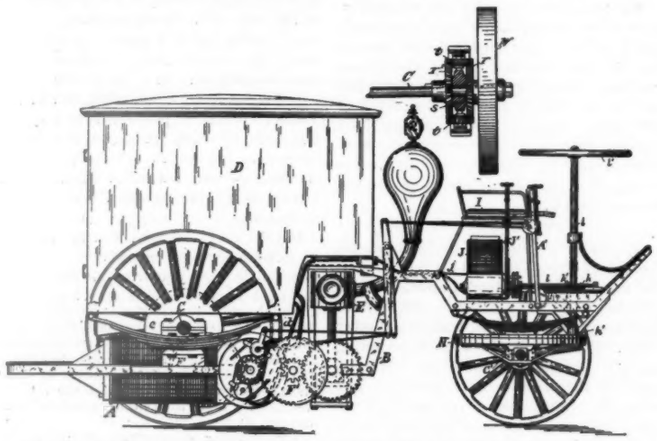
In New York, for instance, several tunnels might be constructed, some of which could

(Continued on page 42.)

PROGRESSIVE ELECTRICAL INVENTIONS.

ELECTRIC FIRE ENGINE.

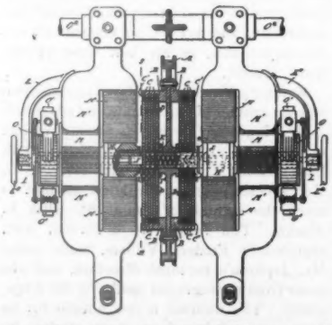
Notwithstanding the great weight of the storage battery, applications for driving vehicles other than railway cars, which move over a smooth line of way, are occasionally made. In the accompanying engraving we illustrate an improvement in electric fire engines made by Mark W. Dewey, of Syracuse, N. Y. As will be seen from the engraving, the engine is provided with an electric motor A, which is used both to propel the engine to the place of service and to operate the pump. The electrical energy to supply the motor is



furnished by a storage battery mounted upon the structure in a suitable containing box, marked D in the drawing. The engine is also provided with a steering device electrically operated, a small motor J controlled by a hand-wheel i, being mounted on the front part of the frame to direct the front axle at any angle desired. In the drawing, portions of the frame-work are broken away to illustrate the gearing. The rear axle C is provided with a compensating gear (see detached view) to facilitate turning corners. One of the drive wheels W turns freely upon the axle, the other being keyed fast. A bevel gear r is fixed to the hub of wheel W, and a similar gear r' is keyed to the axle. Between the two revolves a spur-gear s, which is driven by the motor A, and carries two bevel pinions t t engaging both wheels r r'. As long as the tractive resistance of both wheels is the same, the spur-gear s will carry both at equal velocities, but in turning a corner, the greater resistance on the inside wheel retards that and the outer one moves more rapidly. Brush shifting devices, connected with levers within reach of the driver, control the starting, stopping or reversal of the motors. The speed is regulated by shifting the brushes on their commutators by means of suitable clutches not shown in the drawing. The motor A may be connected either with the driving mechanism of the vehicle or with the pump.

ELECTRIC LOCOMOTIVE.

In the accompanying engraving is illustrated an improvement in an electric loco-



motive designed by Mr. E. M. Boynton, of West Newbury, Mass. The motor is designed for use with an electric bicycle designed by the same inventor. The motion of the armature is transmitted directly to the drive wheel without the intermediation of gear wheels. In order to make this practicable, especially at times of starting, when the low counter electro-motive force ordinarily developed would permit the supply current to burn out the armature, Mr. Boynton permits his armature to be disconnected or unclutched from the drive wheel, so that its inertia may be readily overcome and a normal amount of counter electro-motive force developed before the armature shaft is clutched with the drive wheel. It not only assists the vehicle in starting from a position of rest but insures the safety of the winding. As illustrated in the engraving, A represents the drive wheel, which is sleeved upon a central shaft supported in bearings in the field magnets, M M^1, which are pivoted upon a fixed part of the car frame, the lower end, as shown in the bottom part of the figure, being spring-supported. The drive wheel A carries a drum, upon which are mounted a series of annular disks C, so placed as to permit a similar set of disks mounted on the shaft to interlap, one set of disks being carried with the shaft and the other being fixed to the drum. There is a frictional resistance between them which may be regulated by means of wheels L^2 L^3 forcing the plates into loose or tight contact with the co-operation of a spring K. This apparatus constitutes a variable friction-clutch.

A Patent Wire Stretcher.

Wiremen and all parties engaged in running wires for electrical purposes cannot fail to appreciate this innovation in the line of construction tools, recently placed upon the

IMPROVED WIRE STRETCHER.

market by L. E. Wilcox & Company, of Meriden, Conn. It is claimed that by its use one wireman can do the work ordinarily requiring two. The work is done with great neatness and facility, and is not an eyesore, as by old methods.

To use the stretcher it is only necessary to fasten it to the ceiling at one end of line by means of screws; then, after fastening the wires at the other end of the line by means of cleats or porcelains, pass the ends of wires around the ends of the wooden nut and stretch the wires by turning the screw until wire is perfectly taut, and all kinks have disappeared. Then place cleats and rosettes, and take down the stretcher and proceed with the next span in like manner.

A Seven-Year Contract.

The Hyde Park, Mass., Electric Light Company have received from the town a contract for lighting the streets seven years. This contract has been awarded after thorough investigation, and also in competition with other companies in the matter of bids, etc., and is conceded by all to be an excellent contract, both for the local company and for the town.

Electricity in the Legislature.

The Senate Committee on City and Town Government has committed the grotesque absurdity, first perpetrated and then repented of in the Assembly, of amending the electric railroad bills in such a way as to exclude San Francisco from their provisions. Modern science may have full swing in Oakland, San Jose and Los Angeles, but in the metropolis of the State, which, under natural conditions, would have more electric roads than all the other cities of California combined, the inhabitants and the strangers within their gates must travel by horse, mule or cable power, or walk.

The humiliating report is abroad that the San Francisco delegation in the Senate is solid for this idiotic or rascally provision, whose effect, if the Legislature should be shameless enough to enact it, would be to make this city the laughing-stock of the civilized world. Should the bills pass in their present shape, San Francisco would possess—we do not say enjoy—the distinction of being the only city on earth whose people were forbidden to avail themselves of the most perfect motive power known to man.—*San Francisco Examiner.*

Electric Railways in Rochester.

The New York *Times* of yesterday contained a dispatch from Cleveland discussing the operations of the electric car system in that city and Boston. The correspondent gave the most doleful story, representing the electric system as a nuisance, a menace and a failure.

Rochester has had two lines in full operation for weeks. They are among the most important routes in the city. They have been running during the worst season, encountering heavy snow and sleet storms and with inadequate equipment, so far as the motor power is concerned, on account of the failure of manufacturers to meet their engagements in supplying engines and dynamos.

Yet with some drawbacks, that obviously will be remedied as soon as the plant is completed, the electric system here has been a grand success. People living on the lines already equipped would no sooner think of going back to the former slow and dirty horse car system than they would think of substituting the old stage coach for the modern vestibuled railroad train. In a two miles run on the Lake avenue route there is a difference of from eight to 12 minutes in favor of the electric cars.

We cannot speak for Cleveland or Boston, but if the *Times'* correspondent tells any such yarns about the Rochester electric cars as he has about those of the cities named, we shall nail him as a gigantic prevaricator. —*Rochester, N. Y., Herald.*

American Institute of Electrical Engineers.

A good sized audience comfortably filled the lecture room at the house of the Mechanical Engineers the evening of February 24. Mr. Oscar T. Crosby gave an interesting address on "Electric Traction at 120 Miles an Hour." Mr. Franklin Leonard Pope had on exhibition a model of a circular electric railway built by Thomas Davenport, the Vermont blacksmith, in 1837. The council of the Institute met at 7 P. M.

Eureka, Kan.—The Eureka Light and Ice Company; capital, $30,000.

Pueblo, Col.—The Pueblo Electric Railway Company; capital, $300,000.

Cortez, Col.—The Cortez and Dolores Telegraph and Telephone Company; capital, $2,000.

Corapolis, Pa.—Corapolis Electric Light Company; capital, $5,000.

Merchantville, N. J.—Wellwood Electric Company; capital, $40,000.

Los Angeles, Cal.—California Arc Lamp Company; capital, $1,000,000.

Bowling Green, Mo.—Bowling Green Electric Company; capital, $6,000.

Stoughton, Mass.—Stoughton Gas and Electric Company; capital, $30,000.

Baltimore, Md.—The Baltimore Electric Refining Company; capital, $500,000.

Washington, D. C.—The National Electric Car Company; capital, $250,000.

Portland, Me.—Electric Wire Safety Attachment Company; capital, $200,000.

Brooklyn, N. Y.—The Commercial Electric Company, Limited; capital, $5,000.

New York City.—Himmer & Anderson Dry Battery Company; capital, $50,000.

Jermyn, Pa.—The Jermyn Electric Light, Heat and Power Company; capital, $10,000.

Milwaukee, Wis.—The Wisconsin Electric Light and Power Company; capital, $50,000.

Topeka, Kan.—The Topeka Water and Electric Power and Irrigation Company; capital, $25,000.

Newark, N. J.—The European Weston Electrical Instrument Company; capital, $200,000.

Cincinnati, O.—The Cincinnati Edison Electric Illuminating Company; capital, $1,000,000.

Milwaukee, Wis.—Milwaukee Power and Light Company, Milwaukee, to manufacture and operate light and power plant; capital, $150,000.

Kansas City, Mo.—The stockholders of the Kansas City Electrical Works have voted to increase the capital stock from $10,000 to $25,000.

East St. Louis, Ill.—The Universal Motor Company; capital, $20,000,000. Yerman Kehl, Alex. S. Mann and John Tremlett, incorporators.

Cicero, Ill.—The Cicero Water, Gas and Electric Light Company filed a certificate setting forth an increase of capital stock from $130,000 to $190,000.

Chicago, Ill.—Standard Telephone Company; capital, $50,000; to manufacture telephones, appliances and attachments. Incorporators, W. E. Robinson, G.V. Nauerth, L. A. Fish.

San Francisco, Cal.—Pacific Telephone Attachment & Record Company; capital, $100,000. Directors: Henry Wadsworth, Wm. B. Wilshire, H. G. Phillips, H. T. Dugan and L. L. Bromwell.

Cathlamet, Wash.—The Columbia River Telegraph Company has been organized, and the following officers elected: President, J. G. Megler; vice-president, Howard Winter; secretary, G. Y. Carleton; treasurer, David Wests.

Minneapolis, Minn.—Minnesota Electric, Gas and Mantel Factory; capital, $25,000. The incorporators are: George A. Mitchell and Edward E. Clark, of Minneapolis, and Clifton B. Deacon and Frederic C. Armstrong, of Winnipeg.

Topeka, Kan.—The Marion City Water and Land Electric and Power Company, of Marion County; capital, $150,000. Directors, S. L. Gillett, Samuel J. Friendly, J. S. Reynolds, Platt V. Bryan, Elmira, N. Y.; and William D. Dudley and Samuel F. Sackett.

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NEW YORK, MARCH 7, 1891.

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The Rapid Transit discussion at the Electric Club proved to be a valuable addition to the literature relating to this important question. The meeting was a pronounced success.

The Court of Appeals handed down decisions, February 24, affirming the convictions of the murderers Nicola Trezza and Charles McElvaine. The question now is: How will they be executed? Let us hope, for the credit of the State, that electricity will not be tried again.

The New York *Press* has taken the unique stand of being the only daily paper in this city to stubbornly buck against the adoption of the trolley system by the Harlem and Morrisania road. This policy of catering to the interests of a benighted few can result in no permanent good to the paper. As Brother Joe Howard might say, the *Press* could exercise "unique-uity" in other and more progressive directions.

Mr. Edward Weston's remarks, delivered at the Electric Club, Thursday of last week, appear in full in the REVIEW this week. Our readers will find them full of chunks of wisdom and practical common sense, and rapid transit advocates should carefully read them.

With no conduits available, house-top privileges refused and all poles to be cut down within 90 days, the lot of telephone wires in this city is certainly an uncertain one. It is a wonderful triumph over almost appalling difficulties that the Metropolitan Company gives the excellent service that it does.

The complete, interesting and valuable report of the recent Electric Light Convention and Exhibition, contained in the last issue of the REVIEW, evidently greatly pleased our readers. Many unlooked for compliments and congratulations have been received at this office. The Convention and Exhibition was the greatest in the history of the Association, and the ELECTRICAL REVIEW, as was expected, thoroughly comprehended and encompassed it.

The Governing Board of the International League of Press Clubs held a very successful meeting, at the Hotel Imperial, in this city, last week. Members were present from Baltimore, Grand Rapids, Buffalo and other cities. Plans for the San Francisco meeting and for extending the usefulness and influence of the League were discussed and adopted. Committees were appointed to carry out in detail the most important work. A very enjoyable dinner was tendered the Board by Chairman W. R. Worrall, of New York, with President John A. Cockerill, of the New York Press Club, and Foster Coates, president of the Pittsburgh Convention of the League, present as his guests. A delightful evening was spent, after the dinner had been thoroughly discussed, in journalistic reminiscences, and it was discovered that nearly every newspaper man present was a practical printer, and had served his apprenticeship as the "devil" in a country newspaper office.

LIGHT THE TUNNELS!

At the coroner's inquest on the victims of the Fourth avenue tunnel accident, Louis Fowler, the engineer of the New Haven train which crashed into the shop train ahead of it, testified that in some places in the tunnel he could see no further ahead than the end of his locomotive. He had no way of telling the condition of the track, except by the block signals. The railroad company depends entirely on the block system for the handling of its trains while in the tunnel.

The human link in the chain of apparatus used to govern trains in motion is introduced in the operation of block signals. Whether the operator in the signal tower is to blame for this horrible accident is a matter for the jury to settle. Nevertheless, it is at this point that the element of error is most likely to enter into the problem and become apparent by just such an accident as that which occurred. The proper lighting of the tunnel, either by incandescent or arc lamps, would enable an engineer to see a train ahead of him in ample time to stop his own train. What must we say of a railroad company which neglects to protect its passengers, engineers and signal men to the extent of allowing one of the most critical sections of its road to be kept in utter darkness?

It is encouraging to note that at a meeting of the Board of Aldermen, February 24th, Mr. Morgan introduced an ordinance making it unlawful for any person or corporation to run trains in the Fourth avenue tunnel above Forty-second street, "unless said tunnel or tunnels be lighted throughout at all hours of the day and night by electricity or other suitable means." The ordinance was referred to the Committee on Law. It should, and doubtless will, pass.

If, by the sacrifice of the lives of five helpless people, measures are adopted which will enable the many thousands who travel through this tunnel to go along in safety we may say with Voltaire, *"L'erreur a son mérite."*

FIRE TELEGRAPHS.

The advantages of a widely extended system of electric fire alarm calls have long been recognized in all American cities, and the startling rapidity with which the engines appear on the scene of a fire is always a source of wonder to visitors from abroad. There can be little doubt but that New York owes its immunity from great conflagrations, involving large property losses, and from fires fatal to human life, as much to the electric alarm boxes so liberally distributed throughout the streets of the city as to the highly efficient organization of the fire brigade.

There is no city in the world which has greater need of the very best that can be had in the way of a fire-extinguishing service than London, and it is curious to note how slowly the electric street fire alarm system has been adopted. In a recent article published in our London namesake, Mr. R. Von Fischer Treuenfeld points out the very limited extent to which fire telegraphs had been adopted in the British metropolis, notwithstanding the very noticeable effect of their introduction in the decreased percentage of serious fires.

In 1880, street call boxes were first installed in London, and the percentage of serious fires fell in that year from 9.3 per cent. of the total number of fires to 8.7 per cent., although only 40 street alarms were established. In five years the number of street call boxes had only been increased to 263, and the percentage of serious fires had fallen to 7.1. In 1890, the total number of street alarms had arisen to 385, and the ratio of serious fires to the total number had fallen to an even six per cent.

This showing is excellent, as emphasizing the value of electrical communication for such a service, but the figures show plainly that the number of call boxes should be increased very considerably. Any one who is at all familiar with the magnitude of London, will readily understand that 385 call boxes are wholly inadequate to place the fire telegraph system of that city on a basis in the least degree in accordance with its needs. As Mr. Treuenfeld points out, the number requires to be, at least, tripled, in order to provide reasonable protection against the occurrence of great conflagrations. In such matters as this, London has yet a great deal to learn from New York and other American cities.

LITERARY.

"Technology Quarterly" for November, 1890, has been received.

"Bulletin de la Société Internationale des Electriciens" for January, 1891, is at hand.

We have received the "Year Book" issued by the New York State Reformatory at Elmira.

"Seventh Biennial Report of the Board of Directors of the Kansas State Historical Society" has reached us.

The March *Century* has a third installment of the famous Talleyrand Memoirs. This installment deals with Napoleon Bonaparte, Josephine and the Emperor Alexander.

It is not difficult to see the reason for *St. Nicholas'* growing subscription list, if one will but examine the pages of the successive numbers with the eye of a child-reader. From the picture of cosy comfort which Mr. J. H. Dolph has furnished for a frontispiece to the March number, to the naive idea contained in the last bit of verse, "Her Little Shetland Shawl," there is nothing that an intelligent boy or girl cannot understand and appreciate, and yet all the contents are unhackneyed and, in the best sense of the word, artistic.

Scribner's Magazine for March contains two strking articles of exploration and adventure—Mr. Mounteney Jephson's account of one of the most exciting periods of the Emin Pasha Relief Expedition, and Mr. M. B. Kerr's description of the latest attempt to reach the summit of Mount St. Elias, in Alaska. The former is illustrated with sketches by Frederic Villiers, made under Mr. Jephson's personal direction, and the latter from photographs made by the Expedition. The number is also notable for its fiction, containing four short stories, by Mrs. Robert Louis Stevenson, Richard Harding Davis, Duncan Campbell Scott and W. H. Woods—all of them writers whose first short stories have appeared in this magazine.

CORRESPONDENCE.

OUR BOSTON LETTER.

The Builders' Insulating Tube Company has been incorporated under the laws of the State of Maine with a capital stock of $100,000.

The Manchester, N. H., Electric Light Company has added to the equipment of its station one of the Thomson-Houston improved generators.

Mr. E. H. Peck, of the Phoenix Glass Company, Pittsburgh, Pa., was in the city yesterday and to-day advancing, as usual, the interests of his company.

The Warren S. Hill Electric Company, of this city, the recently organized electrical enterprise, will soon place before the trade a number of specialties possessing great merit.

Mr. A. L. Russell, of this city, the well-known manufacturer of electrical and scientific instruments, is about to put on the market several new rheostats and galvanometers.

The Nashua Iron Foundry, at Nashua, N. H., is installing an isolated electric light and power plant and will hereafter illuminate its works and drive all its machinery by electricity.

Mr. M. W. Robinson, of Medford, Mass., took out a patent recently on a galvanic battery which he has assigned to the Vulcan Electric Company, a newly organized enterprise, located at Kittery, Me.

Pittsfield, N. H., Electric Light Company has made application for a charter and will soon commence work on the proposed new station and soon make preparations for furnishing arc and incandescent lights and electric power in the town named.

Mr. George F. Steele, of this city, for many years identified with the Sprague electric railway interests in New England, and now connected with the electric railway department of the Edison Company in this section, was married in this city to Miss Mabel Louise Southwick, February 18.

Messrs. Claflin & Kimball, of this city, are comfortably located in their new and commodious quarters on Bedford street. For a number of years these young and energetic business men have ably represented the Mather Electric Company, Perkins Lamp Company and Perkins Electric Switch Manufacturing Company.

The Hyde Park Electric Light Company has successfully furnished the town of Hyde Park, Mass., with arc lights—street and commercial—for several years past. The town authorities, at a meeting Monday evening, February 23, contracted with the company for 105 arc lamps for seven years at $7,000 per year, to burn from dark until 12.30 A.M. W. I. B.

Boston, February 28, 1891.

OUR ALBANY LETTER.

Bath, N. Y., is deeply considering the project of plans for electric lighting. A diagram is on exhibition showing how well 35 electric lamps will do it.

Jamestown, N. Y., has closed a contract with the Fort Wayne Electric Company for an electric light plant for the city. It will consist of 150 arc lights, and will be completed by the first of May.

At Cortland, N. Y., the exhaust steam of the electric light plant on Elm street is to be conducted under the railroad tracks, and used to heat the brick building of the Hitchcock Manufacturing Company.

Mr. Roesch Introduced a Bill in the Senate Monday validating agreements between the New York Subway Company and the Consolidated Telegraph and Electrical Subway Company, adopted December 15, 1890.

A Bill was Introduced in the assembly Monday by Mr. W. G. Byrne, providing that every corporation operating a railroad within the State shall immediately cause all tunnels over 200 feet in length, through which their road runs, to be thoroughly lighted by electricity at all hours of the day and night, and to put and keep such tunnels in a proper state of ventilation.

The Saratoga, N. Y., street commissioners have adopted a novel method of keeping track of the lamps which go out in the night. It is in the shape of a small book with detachable leaves, upon each of which is printed the following: "Street, between light, time out, and officer," with a blank space opposite each to be filled out by the officer. Each police officer has been presented with one.

At Whitehall, N. Y., active work has been begun on the electric light plant. President Rich has been in town and laid out the work for the men. On the east side of the creek the men have begun stringing the wire. There are about 13 miles of wire to be strung. Mr. Charles Carpenter, of Greenwich, has charge of the work. He has two assistants. The work of wiring will be completed and the dynamos will follow as soon as possible.

Two Large Pieces of Curbstone were discovered on the rails of the electric railway at Auburn, N. Y., on the night of February 19. A plank had been placed in about the same spot the night before. The Auburn City Railway is determined to bring the scoundrels who would wreck its cars to justice. There was a rumor prevalent recently that the company was taking active measures to construct a branch of its road in Genesee street, as far west as the grounds of the Cayuga County Agricultural Society.

The North American Construction Company, of Pittsburgh, Pa., proposes that Saratoga Springs, N. Y., shall be well lighted. This is the corporation that put in the electric light plant at The Geysers for the Consumers' Gas and Electric Light Company, which has recently been placed in the hands of a receiver. The latter company having become embarrassed, the Construction Company retained possession of the plant, despite the effort made to capture it in the interest of the newly-organized Consumers' Company.

The Hudson River Telephone Company has, by the termination of a lease, come into possession of the property and franchise of the New York and Vermont Telephone Company. The Hudson River Company formerly confined its business to the main lines around Albany. Several branch lines were leased to other companies, among them the Union of Saratoga, and the Schenectady, Amsterdam, Gloversville, Hudson, Catskill New York and Vermont Companies. These leases were given by the Hudson River Telephone Company when it controlled the territory over which the various lines were operated. Subsequently, another syndicate was formed, which purchased the leases of all the lines except the Union of Saratoga and the New York and Vermont. There is talk of forming another syndicate to include some of the cities along the Hudson and at interior points. L. M. W.

Albany, February 28, 1891.

GENERAL ELECTRICAL NOTES.

Clarsdale, Miss., is to put in an electric light plant.

A patent has been granted H. R. Butterfield, of Waterville, Me., on a vacuum core for electrical heating device.

Upper Sandusky, O., is to have a telephone exchange. Fifty-five subscribers have been secured and work will be begun at once.

It is reported that $20,000 of the $50,000 bonds issued recently by Jackson, Tenn., will be used for the erection of an electric light plant.

Ten sheep shearing machines run by motors among Australian sheep farmers have paid in one season the cost of putting up the machines by the extra value of the clip of 13,000 sheep.

The annual report of the Thomson-Houston Electric Company is now nearly completed, and will probably be issued within a week or ten days. The report is said to be the most complete ever compiled by the company.

According to the report of the railroad commissioners of Maine, the Augusta, Hallowell and Gardiner Electric Railway showed net earnings of 38 per cent. on $108,000, cost of construction and equipment of the road, during the time it operated, from July 26 to September 30.

A pleasant incident of the rapid transit dinner at the Electric Club last week, was the exhibition of the first electric railway, built by Thomas Davenport, the Vermont blacksmith, in 1837. Mr. Geo. M. Phelps, of the *Electrical Engineer*, put the motor in operation and explained its principle briefly.

An ingenious electrical balance was recently exhibited in Paris. The object to be weighed was placed in the pan, by which act an electric circuit was closed and a motor put in operation which moved the weight out on the beam of the balance. When the equipoise was established the circuit was broken. Upon emptying the pan the weight returned.

The coroner's jury of inquiry into the Mammoth mine disaster, has rendered a verdict exonerating the H. C. Frick Company from blame for the explosion. The verdict contained recommendations that in all mine workings below water level electric lamps in safety covers should be used, and that companies keep a record of all persons who enter a mine.

The House Committee on Foreign Affairs agreed last week, though not unanimously, to report to the House, with some modifications, the bill to incorporate the Pacific Cable Company. Representative Chipman will report the bill. The principal change made in the bill was to reduce from $200,000 to $150,000 the sum to be paid to the company annually for 15 years by the United States government after the cable is completed and open for business.

Electrical Exhibits at Worcester, Mass.

On Monday, February 23, an exhibition of electrical and mechanical products was opened to the public at Bigelow's Rink, Worcester, Mass., and will be continued through the month of March.

Only a brief description of the electrical and kindred industry exhibits is here given:

Messrs. J. S. Wheeler & Company, of Worcester, show their improved 22 inch iron planer, six feet in length.

Messrs. J. C. Speirs & Company, of Worcester, exhibit an attractive show board containing samples of their iron and steel drop forgings.

The Winslow & Curtis Machine Screw Company, of Worcester, Mass., exhibits samples of its entire line of machine screws, Mr. H. Landers in charge,

Charles E. Green, of Worcester, has an exhibit of electric gas lighting apparatus and electrical specialties, shown to advantage on a large show board.

Washburn & Moen Manufacturing Company makes one of the largest and most attractive of the exhibits, comprising samples of their entire wire product.

Messrs. L. Cees & Company, of Worcester, have on exhibition a full line of their popular manufactures, including the widely known "Lowell" wrench."

Worcester Oil Works, of Worcester, furnish the oil used on the dynamos and motors in operation at the exhibition, and it is giving thorough satisfaction.

Thomson Electric Welding Company shows a neat line of samples illustrating electric welding, forging and brazing, Mr. Charles E. Harthan in charge.

Messrs. E. A. Richmond & Company, of Worcester, have an extensive exhibit of carriages and coupes with electric side lights operated by storage batteries.

Messrs. Wm. Allen & Sons, of Worcester, the well-known boiler makers have on exhibition their new Standard feed water heater and improved heating boiler.

Messrs. Geo. Burnham & Company, of Worcester, exhibit two of their upright drills; either for hand or power, and especially adapted for light machine work.

Messrs. G. W. Barnes & Company, of Worcester, have on exhibition a large variety of electrical goods and supplies, neatly displayed on a sample board and in a large show case.

The Norton Emery & Corundum Wheel Company, of Worcester, make an extensive exhibit of their useful products and special machinery; the latter includes the Worcester drill grinder.

Dr. R. O. Wood, of Worcester, has on exhibition his triple toggle joint track and wheel brake, which may be simultaneously operated with any suitable brake power mechanism at either side of a street car.

Messrs. Warrens & Company, of Worcester, manufacturers of oak belting, exhibit their product in use running a line of shafting off a Daft electric motor; also have on exhibition various sizes of the "Dodge" wooden pulleys.

Messrs. Waters & Culver, of Worcester, exhibit a variety of electrical goods on a large sample board; also a varied line of electric gas lighting apparatus and incandescent lamps and fixtures. They also make a neat display of electric bells and hotel annunciators.

An Electric Street Car is exhibited by the Daft Manufacturing Company and is equipped with the system introduced by that company. The car runs almost the entire length of the lower floor of the exhibition hall and affords considerable pleasure to the visitors. The double trolley device of Frank Wheeler, of Meriden, Conn., is used.

The Electric Stove exhibited by Mr. S. C. Harthan, of Worcester, is one of the most interesting of the attractions. In the fire-box are two coils of German silver wire encased in a thick covering of asbestos. When electric current is applied from either an accumulator or incandescent circuit, heat is quickly generated sufficient to cook meats or vegetables.

An Electric Boat on trucks and wheels is another of the most novel and attractive exhibits. It is operated by a Franklin motor, and with the aid of Mr. Frank Wheeler's double trolley devices, makes successful trips from one end of the hall gallery to the other on ordinary street railway tracks. This boat-car performs excellent service and affords much amusement to the visitors.

The Switchboard is noticeable from the fact that it is simplicity personified. It comprises only one main switch and a fuse box; no resistance box is necessary. This is remarkable when the variation in the load carried by the dynamos and the distance the current is carried is taken into consideration. Mr. H. A. Larned is the electrician in charge and he is ably assisted by Mr. J. F. Macartney.

Mr. C. H. Page & Company, the pioneer electrical supply and construction house of Worcester, make a very creditable exhibit with the senior member of the firm in charge. Among the many attractive electrical goods, specialties and novelties shown by this firm, is a large electric chandelier with the lights operated by an electric friction machine; the lights being turned on or extinguished at will by gently turning the handle of the machine to the right or to the left.

Franklin Electric Company, of Peabody, Mass., has on exhibition several of their electric motors and a 50 light (incandescent) dynamo. The former furnish power for various purposes about the hall, and the latter affords brilliant illumination for the company's own exhibit. One of the motors operates an electric hoist. This hoist is a new departure both in construction and finish. Its peculiar and meritorious features will be described later on in these columns. Mr. T. F. Lawrence, electrician for the company, has charge of the exhibit.

The Eureka Electric Company, of New York, give an extensive exhibition, showing the Loomis system of electric lighting and power off same circuit. A temporary plant, for purposes just named, was recently installed in the Baker building, nearly a block away from the exhibition hall, and the equipment includes two Loomis dynamos, one of 500 and the other of 400 incandescent lights capacity, both driven by a Jerome-Wheelock engine. Nearly all the lights and current for the motors now in the exhibition hall is derived from the plant mentioned.

Among the other numerous electrical supplies most conspicuous is a revolving lamp, Eco-magneto electric clock, annunciators, electric fire alarm apparatus and electric gas lighting specialties. W. I. B.

Board of Electrical Control.

Three important resolutions were passed by the board at a meeting held February 27. The first directs the Consolidated Subway Company to proceed to the construction of subways wherever required in those streets which are to be repaved. The second orders all electrical companies now maintaining housetop wires in sections where there are subways to remove them within the next 30 days, and if they fail to do this the Commissioner of Public Works is directed to remove them. The third proposed resolution is the most important. It recites that subways sufficient to accommodate all electric light and telegraph and telephone wires are now in readiness in the district bounded by Third and Eighth avenues, Eighth and Fifty-ninth streets, and orders all companies now having overhead wires and poles in that district to secure accommodations in the subway and remove their poles and wires before June 1. Failure to comply with this will be met by the Commissioner of Public Works, who is directed by the resolution to remove all poles and wires in the district after June 1.

Paul D. Cravath, counsel for the United States Electric Lighting Company, objected that his company has wires in some parts of this district in which there are no subways. The Board agreed to let these wires, which are used for lighting street lamps, remain undisturbed until subways are built. Mayor Grant told the representatives of the electric lighting companies who were present that the Board was in earnest, and would follow out the provisions of the resolutions in spite of any excuses that may be offered in the future. He said that if permits to open the streets are applied for in time they will be granted, but that they will be refused if applied for after the streets have been repaved.

Efforts to have the resolution modified met with failure.

FINANCIAL.

Closing quotations of electric stocks, from F. Z. Maguire & Co., Electrical Securities, 18 Wall street, N. Y., Saturday, February 28, 1891. New York, Boston and Washington Stock Exchanges. Pittsburgh closing February 27.

NEW YORK.	
Western Union Telegraph Co.	81¼
American Telegraph & Cable.	83
Central and South American.	145
Mexican.	210
Commercial Cable Co.	105
Postal Telegraph Cable.	39
Edison General Electric Co.	105
" " " "Deferred.	
Consolidated Electric Light.	
Edison Electric Illuminating Co.	79
United States Electric Light.	80
North American Phonograph.	
BOSTON.	
Thomson-Houston Electric Co.	44⅜
" " " Preferred	25¾
" " " Series C.	19
" " " Series D.	6¾
" " International Co.	
" Welding Co.	
" European Welding Co.	60
Ft. Wayne Electric Co	19½
TELEPHONE:	
American Bell	194
Erie.	47¾
New England.	50½
Mexican	.65
Tropical American.	
MISCELLANEOUS:	
Edison Phonograph Doll.	
WASHINGTON.	
Pennsylvania Telephone.	25
Chesapeake and Potomac.	57
American Graphophone.	7¾
United States Electric Light (Wash'ton).	128
Eckington and Soldiers' Home Electric Railway.	58½
Georgetown and Tennallytown.	60
PITTSBURGH.	
Westinghouse Electric Mfg. Co.	11⅝

RAPID TRANSIT AT THE ELECTRIC CLUB.

(*Continued from page 38.*)

be used for way traffic and others for through traffic, or those living beyond the Harlem River.

Cities of less than 500,000 inhabitants must be content to have such rapid transit as may be afforded them by means of surface roads.

In my opinion, all roads in the near future will be operated by means of power transmitted by electricity in some form.

Thanking you for your very kind invitation, I am,

Very respectfully yours,
Jno. W. McNamara.

President Madden then introduced the following speakers:

Commissioner L. J. Heintz said: We have always felt slighted in the Twenty-third and Twenty-fourth Wards, by the fact that people do not seem to look upon us as part and parcel of the city of New York. The reason why we have been ignored is the absence of the very thing under discussion to-night—rapid transit. People have not had a chance to discover the whole of New York city. We owe it to ourselves to make officials understand that we must have rapid transit at all hazards, and if we do that, we are bound to get it in the near future. (Applause.)

RAPID TRANSIT SITUATION IN NEW YORK.—BY LIEUT. FRANK J. SPRAGUE.

Gentlemen of the Electric Club:

For me to talk of the rapid transit situation in New York, is like a young bachelor indulging in a description of the joys of matrimony. He cannot speak from the fullness of experience; his enthusiasm will be illumined by his hopes, encouragad by the experience of some fortunate Benedict friends, and possibly tempered by the less fortunate experience of others. But when he passes the Rubicon he does so presumably guided by his own needs and inclinations, and, if he be wise, avoiding some of the many pitfalls spread for unwary feet. There is no rapid transit in New York, it is all situation. For years we have patiently sat lean and hungry, with eyes expectant and pangs increasing at a Barmecide feast, and as the guests have multiplied, the scantiness of the table has become more and more apparent. Horse cars served in old Delft, hackney service dressed with cobblestones, elevated railroads *a la fourchette*, and cable roads with sauce of golden promises; all have been set before us, and we have been bidden to eat and be merry. We have eaten and voraciously, but with little satisfaction of appetite. We have become gourmets, our tastes are more refined and luxurious, our needs imperative. The courses which have been served are stale and have lost their flavor. We need a new *chef* and a new *cuisine*. That *chef* is the electrical engineer, and the dish which he aims to provide is a perfect system of rapid transit, operated by electric motors, and set before us with prompt, cleanly and perfect service. Other speakers have told you of the needs of sister cities. New York's are peculiarly her own, and that which may serve iess exacting requirements will fall short of satisfying her. But it may be incidentally remarked that what we seek here ought to satisfy at least in part the needs of others. It was my pleasure a short time since, in an interview with the New York *Commercial Advertiser*, to give my views of what seemed to me the needs of New York, both from its geographical conformation and the movements of its citizens, and what I thought to be the best method of satisfying the universal demand for increased transit facilities. I shall not go as fully into the details here as I did in that interview, because the time allotted to me is necessarily short, and the expression of views by others will prove of sufficient interest, but I briefly outline what I then said.

The formation of New York city, a city 16 miles long and with an average breadth of only two and a half miles, its northern end terminating at the boundaries of rapidly growing suburban towns and villages, and flanked at its lower end on the one hand by a great and prosperous city, and on the other by the terminal cities of the great Western and Southern Trunk Line, but separated from both by broad and deep rivers, bisected itself by the Harlem River, and with a population whose main travel is in one direction, make her requirements peculiarly exacting but imperatively her own. While the needs of New York and not her neighbors must determine the system which should be laid out, there is one way, and it seems to me only one, in which her needs can be well provided for, and the convenience of her neighbors as well.

The American is always in a hurry, and he is, if we include that amalgamated portion of our population which either necessity or good fortune has made it advisable for other countries to bequeath us, very much of a crowd. His business in a large measure requires his presence at one end of the city, while his residential and social obligations make it somewhat important that he should be often at the other end, and a due regard for the comforts and luxuries of life, inducing a strong aversion to an unnecessary waste of time on wheels, has impressed upon him the want of quicker means of transportation.

Then, again, New York is, in a cosmopolitan sort of way, hospitably inclined, and would not deny to her less fortunately situated neighbors, and such other citizens of our blessed country as may visit her, some of the benefits of her civilization.

That New York has for a long time had urgent need of increased facilities is emphasized by the great number of projects which in the past 15 years have been brought forward, and the number which is now under actual consideration. Of many of these mention is unnecessary and time spent on them useless. They were conceived in ignorance of the city's needs, with little conception of its growth and less regard for its future. Not only this, many of them were designed when the architectural possibilities of to-day were not dreamed of for this city; when the values of real estate were undetermined, and before the great strides which have been made in the past three years in engineering construction and the possibilities of a new form of motive power. Being so, they are antiquated and unsatisfactory.

Why New York, with its commercial enterprise, its great resources, its engineering skill, and its position as the metropolis of this country, should be so slow in providing for its wants, is a matter of some surprise; but it may be said that the interests at stake, the magnitude of the question, and the vital importance of the correct solution of the rapid transit question, have well made it advisable that the demand of our citizens shall be most clearly emphasized and most strongly urged before the settlement of so important a problem, and such settlement should be made after a full and careful consideration of every recent advance in engineering, and every possible forecast of what is to come.

Speaking here as a representative of the electrical engineers, I feel that we have cause to congratulate ourselves that the final adoption of any further plans have been deferred until 1891, for we have been witnesses of one of the most marvelous developments recorded in the industrial world, and can point with pride to the fact that the transmission of power by electricity has within the past three years taken an undeniable first place, and offers a ready solution of hitherto impossible problems. That the United States has occupied so prominent a place in this development is a source of unmixed satisfaction.

Only a few years ago you formed a hopeful band of enthusiastic pioneers, poor in pocket, struggling against cynicism and ridicule, but buoyed by belief in your work and encouraged by the bright predictions of a score of early workers who had handed down the record of their work. Five years ago there were, perhaps, a dozen electric railways in the world. The number of motors used for other industrial purposes was small. Capitalists, car-builders, street railway officials, engineers, viewed your efforts with tolerant pity. Even we electricians only faintly realized the practical possibilities. The motor was a piece of fine and delicate machinery to be carefully housed and tenderly protected. It had hydrophobic tendencies in the presence of water and a delightful uncertainty of operation. Its construction was crude, its design unsatisfactory, its function mysterious. The vagaries of the electric current were many and surprising.

When railway work was considered, to put the delicate and erratic machine under a car, exposed to the dust and moisture was indicative of insanity, to connect it with the wheel by gearing an insult to mechanics, and to govern two or more such machines out of sight with fixed brushes and a controlling device in the hands of an unskilled man was to juggle with the devil. To accentuate the waywardness of the current grounding one circuit, and with 450 volts potential, was surely flying in the face of Providence. To operate under the ordinary conditions of street service was pronounced impossible, and to attempt to mount over a six per cent. grade would be to lose one's reputation. The operation of a number of cars on the multiple arc system was thought a commercial impossibility; 450 volts potential threatened unknown terrors of torture and death; the bare overhead wire promised unending conflagrations, while the rail circuit with mud, snow and ice was an electrical impossibility.

How all this is changed! Motors by the tens of thousands are singing songs of victory, and follow our will with implicit and instant obedience, whether near at hand or a score of miles away. We bow before the marvelous power of electricity, but we dictate its operation.

The fear of hydrophobia has passed. The six per cent. grade has become 14. The difficulties of gravity have been reversed. The trouble is not how to get up, but how to get down, and here again the electric motor, by reason of its remarkable reversibility of functioning, admits of possibilities denied to other forms of braking.

Boston, Cleveland, Milwaukee, Minneapolis, St. Paul and St. Louis, with all their adverse conditions of ice and snow, support the largest electric railway systems. Of all the thousands of people employed in the various duties of electric railway work, not one has ever been sacrificed by contact with the standard pressure which has been adopted for street work. Over $50,000,000 represents the investment of one class of electric motor work alone in this country.

Such has been the change wrought within the past three years. Can any observing man avoid the conclusion outlined by these facts; that the electric motor must not only be the propelling power of any rapid transit system in this city, but that system in its entirety must be designed with special reference to its use?

Not alone in street car work, where the electric motor now holds undeniable sway, but already in inter-city communication it is outstripping the steam locomotive.

Between Minneapolis and St. Paul, a distance of 10 miles, 13 cars are performing an eight minute service at good speeds in competition with the old established steam railway half-hour service, and although the fare, including transfer to the city systems, is less than one-half that charged on the steam service, the operation of the cars is a most remunerative business. An electric railway line over 100 miles in length is now seriously projected in Austria. My own investigations have convinced me that at a frequent interval rapid service is perfectly feasible between here and Philadelphia.

A most instructive table has recently been made showing a comparative statement of earnings of horse, electric and steam railways for city communication. This table comprises returns for all the street railways of Massachusetts, the entire West End Railway System of Boston, the Manhattan Elevated Railroad, and three specimen divisions of horse and electric railway service in Boston, and show the car mileage and passengers carried, the receipts, operating expenses and net earnings per car mile and per passenger carried. The figures are most suggestive and they bear out in a remarkable way my own claims and prophesies of electric railway possibilities some years ago. To quote a few of the results, I find that on the Massachusetts railways with about 24,000,000 miles car mileage and nearly 150,000,000 passengers carried, the operating expenses per car mile are 25¼ cents, of which about 10½ cents is for motive power, while the percentage of operating expenses to passenger receipts is 82 per cent. This almost exactly represents the facts on the entire West End Railway System when operated by horses. Coming to a more recent period, I find that with three horse divisions making something over 3,000,000 miles, and carrying nearly 20,000,000 passengers, the operating expenses per car mile are a shade under 25 cents, with the percentage of expenses to receipts about the same as before, 81.7. Three electric divisions making nearly 2,500,000 miles and carrying nearly 16,000,000 passengers, give operating expenses of 20¼ cents, and the percentage of operating expenses to receipts 64 per cent.—a most remarkable showing. Compare these figures with those of the operation of the Manhattan Elevated Railroad, which for the year ending September 30, 1889, made nearly 31,000,000 miles, and carried nearly 180,000,000 passengers. Its operating expenses per car mile was 17⅞ cents—a little over 2½ cents below that of the electric system, and the percentage of expenses to receipts 60.4 as against 64 per cent. for the electric system.

It has been generally supposed that this steam system was much more economical, but when we consider the tremendous traffic on the elevated railroads, and the fact that while they only have one engine to every four large cars, under exceptionable care, and they are the product of years of best development and experience, while the electric cars have had one and two motors for each car, exposed to the worst possible conditions, and with only practically three years' development, the difference of operating expenses is more than made up by repairs, and I think we can safely say that the electric motor has already impressed its stamp of commercial supremacy in the unerring imprint of dollars and cents, and with the future electric motor designed to meet the conditions of train service, subject to the same care that the steam locomotive is, there is no question that it will undeniably be far in advance. So much for electricity. How should it be used? What shall be the routes over which to operate? What shall be the form of road? Shall it be elevated, surface or underground? How many tracks shall it have and what shall be the system of train service? Thanks to the electrical development and thanks, also, to other modern engineering advances, and especially as they have been so cleverly and intelligently put into practical operation by Mr. James Greathead, whose representative I see here and who is better able than I to describe his methods as applied to the City and South London Electric Railway, as well as other work. The answer to these questions seems to be an easy one, and it is an answer which a very few years ago could not have been given.

Let us briefly review some of the proposed systems of transit and consider what is an essential in New York. Numerous propositions for years fought for have been made for replacing the horse car service by cable lines and it has even been proposed to grid-iron the city with such a system. That the cable, when properly put in, is an improvement on horse car service can freely be acknowledged; somewhat faster time can be made, heavier loads can be carried, trains can be operated in one, two or three car units, and it is unquestionably more cleanly; but with these acknowledged advantages, its defects are many and too well known to make it necessary to here enter into them. It is sufficient for our purposes to bear in mind the fact that it is a surface road, necessarily subject to surface limitations, and that by no possibility can it ever give rapid transit to New York city. No more conclusive proof of this is necessary than the statement that on the proposed Third avenue cable line the different sets of cables are to operate at four, six and eight miles, and the schedule speed would be about six miles an hour; but even this line, and the Broadway line as well, seem, in spite of all their promises, to be holding back for some reason before irrevocably committing themselves by actual construction to the great expense necessary. Is it not possible that the secret influence at work is a sudden awakening to the advance of electricity, which we all know will enable even a surface system to be run in a city street at at least a third safer mean speed than any other system of propulsion.

And then we have our present elevated railroad system, with its proposed changes, and our suggested viaduct roads. The latter, by reason of the limitations which largely govern the elevated railroads, independent of the serious one of great cost, need not be considered separately from the elevated system. Of the not unmixed benefits which this system has conferred on the city of New York, I am only too glad to make admission, but it has many and some insuperable objections when considered as a possible solution of the rapid transit question, being a double track system, with frequent stops, without loop connections, subject to street grades and curves and limited necessarily in speed. Its proposed loop connections at the Battery and Harlem River will facilitate train dispatching. It will not increase the schedule time of running; nor is any two track railroad, with the street limitations which exist in the elevated system and with the traffic which it has got to carry, capable of giving high speed service. Fast time can only be had where there is freedom from bad curves and grades, where the tracks are not too crowded and the train intervals too short, where there is a clear right of way and with distances between stops sufficiently long to allow of getting a train up to a high speed and for some time maintaining it. Already on the elevated railroads the maximum speed between stations is from two to three times the mean running speed, and the duty required of engines most excessive for their limited weight and size. Hence, four tracks are an essential, two of which should be devoted to way service and two of which to express service. But four tracks are certainly not feasible in the streets of New York, unless they are placed one set above the other, and that should not be considered for a moment, unless, indeed, a four track viaduct structure should be built. In any event, in such a road, the express tracks would have to follow the line of way of the way tracks. Where, then, shall we put a road? Underground. While I have been an advocate, and still am, to erect one solitary wire for an electric railway system to replace horse car service, and have thought perhaps that the Biblical admonition, "Dust thou art, and into dust thou shall return," might just as well be applied, when necessary, to all electricity as to poor humanity. Despite the somewhat exaggerated claims of my telephone friends, I am no believer in the so-called "God's free air," as applied to rapid transit systems in New York, because what with our lofty buildings, and the occupancy of our streets with the elevated structure and poles of various kinds, we have no free air; but provided we go deep enough, I am a strong believer in God's freer earth, which is our common heritage; so I say again, let us go underground; but this is not all. What shall be the form of the underground construction and where shall it run? Shall it be the deep subterranean rock blasted tunnel, because our ordinary system of blasting and tunnel construction makes us subservient to the necessity of finding a solid rock in which to work, or shall it be a form of tunnel construction which can safely pierce concealed water courses, quicksands and clay? Shall it be a tunnel depending solely for its strength and resistance to pressure from above and on either side to the rocky material through which it is bored? Or shall it be a tunnel providing within itself

effective methods of resistance? Shall it contain one track, or two or four? All these are important questions. Bearing in mind the character of our soil, the accessibility of the system, the necessity of running through and alongside foundations of structures without weakening them, there seems to me but one really available system for New York. Hence I favor, in brief, four independent iron tunnels, all meeting at a common station, once every mile and a half or so, the way tunnels meeting at common stations every third of a mile, every tunnel being absolutely independent in its route except at the stations, the way routes being run to accommodate the best surface intersections for existing lines of travel, and the express route, while passing beneath the way tracks at the common stations, elsewhere running in the most direct possible paths. Such a four track system should run up the east side, thence by loops through the annexed district and at Harlem River, thence down the west side, completing a circuit by way of the Battery. This should intercept with a two track system passing beneath the main system with access from common stations crossing New York on the Forty-second street line and at the Battery, and making connections with the Long Island, Broadway and Atlantic avenue stations on the Brooklyn side and the Trunk Line depots on the Jersey shore. This system comprises about 125 miles of single tunnel for New York, and 30 miles of tunnel in the loop, and would provide a most comprehensive system of intercommunication. The schedule running on way service to be 15 miles an hour, and on express service 30 miles. And how different such a tunnel would be from that which we have known? A rigid iron structure with all vibration deadened by the surrounding soil; an almost perfectly equable temperature; a magnificient road-bed perfectly jointed and free from expansion and contraction; absence from dust, smoke, and cinders; perfect ventilation; a structure unobtrusive in character and absolutely safe; derailment almost an impossibility; a system of braking and signaling unequalled; and a prompt and reliable high speed service. Let us hope that we all may be prominent in accomplishing this result. [Loud applause.]

RAPID TRANSIT IN THE BRITISH METROPOLIS —BY LOUIS STERNE, C. E.

The common desire in all cities is the rapid communication from residential to business centers, and thus to relieve the already overcrowded thoroughfares and existing means of transit, as population grows in any great metropolis with commercial and industrial prosperity, such as London and New York.

New York differs essentially in many particulars from other great centers of population, although the common desire to be quickly transported from place to place is universal in every city; but the configuration of New York city concentrates the pressure of the greater portion of the population, especially as the business portion is at the lower end of the city, and thus compels the movement of the larger part of its male population in opposite directions once in each day. London has always been more favored in this respect as it has had an excellent omnibus service which has trebled in point of numbers, and has numerically increased in its transport of passengers in exact or even greater proportion. The cabs in London, with the strict enforcement of legal regulations and the low rate of fare, have also contributed largely towards the conveyance of persons from place to place. The pressure in London, therefore, is not so great, although they have made the advance over New York in seeking to solve the problem of rapid transit.

Two tunnels were built in London, one by Mr. Brunel in 1860, and one by Mr. Greathead in 1868-9; the former fell into disuse until the Metropolitan Railway used it for the means of reaching the Surrey side of the river, and made their terminal at New Cross, some four miles from the mouth of the Brunel tunnel. The Tower subway, designed and built by Mr. Greathead and Mr. Barlow for omnibus traffic by gravitation, is used only for foot passengers to the extent of about 100,000 a month. The original plans were never carried out for want of funds.

The next approach to a tunnel was the well-known Metropolitan Underground, and since then the District Metropolitan, now known as the Inner and Outer Circle, a small portion of which has cost as much as at the rate of $30,000,000 per mile. These have been supplemented to a very considerable extent by the main lines of railway, both north, south, east and west of London, having their terminals as near the business centers as possible, and with the running powers over the Metropolitan Railway, carrying an immense number of passengers from the suburban districts of London. In addition to this, we have in the city of London between 15,000 and 16,000 cabs, carrying passengers at 12 cents per mile.

Street cars have also been laid down in the streets of London in the last 20 years, but these are not permitted to enter beyond what is technically known as the city limits. Thus their usefulness for a continuous journey across or through the metropolis has been minimized.

Underground Railways.—Many attempts have been made by the Metropolitan and the District Railways, and also by private corporations, as promoters, for increased facilities in London, but the moment they showed on the walls of the committee rooms, either in the House of Commons or in the House of Lords, the old system of disturbing streets and vested rights and properties, with the old method of traction, involving asphyxiating air, porous brick lining, and the smoke and gases of the engine, the bills were thrown out and never came beyond the first committee.

Subway work ceased until cable traction suggested to Mr. Greathead the possibility of making his system of deep tunnelling successful for rapid transit. Mr. Greathead's name is now as well known in Great Britain and is as closely associated with deep tunnelling as the name of Mr. Edison is associated with electricity. Although the cable suggested the possible traction

FIGS. 1 AND 2.—NEW CEILING CUT-OUT.—SEE PAGE 45.

in deep tunnels, electricity solved this problem for Mr. Greathead, as neither safety nor speed in cable traction can compare with that of electricity, and the iron lined and cemented tunnel lends itself perfectly to electric traction.

The American people will not be slow in adopting the improvement thus developed in Great Britain, and which will make underground means of transit as safe and as healthful as the surface roads have been until now; and will also make these substructures in all cities in the United States as important an element as the roads have proved in utilizing the upper streets, and practically doubling the area of the densely populated districts of every great city in the United States. You have not lost much time in adopting these improvements in the mode of rapid transit underground, and you probably have profited by waiting until the advance came to you from Great Britain. Just as you have benefited by postponing the building of a United States Navy and naval armaments, you have been enabled to take advantage of all that has been done, and adopted the best design of the many cruisers which formed the experimental period preceding the rebuilding of your navy, and thus saved many millions of dollars and much vexation; and it may not be long before Great Britain will have to look to the United States for the adoption of many improvements made here.

You are fortunate in having such an earnest and able commission appointed by your chief magistrate—an appointment confirmed by the State, and with full powers to give the necessary facilities for rapid transit in New York, and for New Yorkers especially. [Applause.]

Mr. C. O. Mailloux, speaking of rapid transit in Washington, said: The bill passed by Congress forbids the use of any overhead appliances. That restricts the systems to the underground electrical, the cable and the storage battery. All things being considered, there was only one thing left to do and that was to use the storage battery system, which I hope can be developed to a sufficiently practical state to solve just exactly the problem now before us in Washington.

Mr. H. H. Neil, of the *Commercial Advertiser*, spoke of the relation of the New York press to the city's rapid transit problem, presenting in a most entertaining manner the "momentarily popular," the "probably successful," and the "everlastingly right" aspects of the question.

Mr. T. Graham Gribble spoke on rapid transit in London and New York, with special reference to the topographical characteristics of the latter city. He described briefly the duplex railway system, the adoption of which as a means of solving the rapid transit problem he recently advocated before the commissioners.

Mr. W. J. Richardson, secretary of the American Street Railway Association, said: I received this morning a letter in which occurs this sentence: "Boston, Albany, Washington, Brooklyn, New York and London will be spoken for, and what I want is to leave the rest of the country to you." There is nothing small about the man who includes within the confines of the United States the city of London. [Laughter.] There is nothing insular about Mr. T. C. Martin. Indeed, he can only be adequately compared to the telephone people, who want the earth; or rather, let me say, he is like the generous electrical street railway man, who is willing to divide the earth with everybody. [Laughter.]

Mr. Sterne: I would like to say that I forgot during my remarks to state that the Hudson River Tunnel is now being built on the Greathead system, and we are advancing there at the rate of 10 feet a day. The last two or three days we have really made 15 feet a day.

Mr. Charles E. Emery said: The relations of the electrical systems to steam settle themselves by the facts. We map down a cable running through a groove, but at the end of it we have a steam engine, a boiler and a place to burn the coal. We have overhead a wire which the trolley presses; but at the end of that is the dynamo, the engine and the place to burn the coal. As yet we have no good pyro-magnetic, and so long as you must burn the coal and make the steam, the steam engine directly applied will for very long routes take the lead. The locomotive is not as economical as the triple engine, to be sure, and you can run the dynamos with

(Continued on page 46.)

Telephonic News

*** The McCluer telephone toll boxes, illustrated in a recent issue of the REVIEW, are in extensive use at Richmond, Va., at all the public stations. Of course, subscribers are permitted to use any telephone except at the toll stations, where the necessary coin must first be inserted in the slot before a conversation can be held.

*** At Baltimore the telephone company a few days ago announced that it would soon increase rates and collect tolls upon all messages transmitted by any person other than the renter. The signatures of about 300 druggists have been secured to an agreement to order the removal of telephones from their stores in the event of an increase of rental. It is claimed that 200 more subscribers will sign the agreement.

*** The Casco, Me., Telephone and Telegraph Company have applied for a charter. The intention is to build a cable to Cushing's Island, across Cushing's to Peaks, Peaks to Big Diamond, Big Diamond to Long Island in Casco Bay. They have had requests made to extend the line to Great Chebeague. It is the plan of the operators to use them as telegraph lines in the Summer time, and as telephone lines during the Winter.

*** The annual meeting of the stockholders of the Central New York Telephone and Telegraph Company was held last week. The directors elected are: Robert S. Williams, F. G. Wood, C. A. Nicholson, David B. Parker, Lewis H. Lawrence and Martin A. Knapp and A. C. Belden, of Syracuse. The officers are: President, Robert S. Williams; vice-president, Lewis Lawrence; secretary and treasurer, F. G. Wood; general manager, C. A. Nicholson.

*** At Forty Fort one of the telephone subscribers became so weary waiting for linemen to come around and repair the damage done to his line by the recent storm, that he fixed it himself in a novel manner. One end was fastened to the top barbed wire of a fence made of that material, and the other end attached in the same way to the other end of the fence. The barbed wire acts as a conductor for several hundred feet and does it well.—*Carbondale, Pa., Leader.*

*** At the annual meeting of the Southern Massachusetts Telephone Company, the following officers were elected: Directors, Charles W. Clifford, Oliver P. Brightman, Walter Clifford, Morgan Rotch, Moses E. Hatch, Samuel Ivers, William H. Forbes, Thomas Sherwin, Sidney W. Knowles; clerk and treasurer, Samuel Ivers. At a meeting of the directors, Charles W. Clifford was elected president. An annual dividend of eight per cent. is now payable.

*** A man, representing himself as Andrew J. Guise, an attorney of Baltimore, called on the 3,000 telephone subscribers of Pittsburgh a short time ago and represented himself as the agent of an association formed for the purpose of securing legislation to limit the charges of telephone companies. He secured 1,000 signatures to a paper, pledging the signers to contribute $5 each to a fund to secure the passage of the bill, and $20 additional when the bill is passed. Mr. Guise has not been heard from, and they think they have been duped.

*** Official changes in the Central Union Telephone Company are announced as follows: The assistant general superintendent's office having been removed to Chicago, the jurisdiction of M. J. Carney, superintendent, has been extended, and he has been appointed superintendent of this company for Ohio, the same to take effect from February 25, 1891. Mr. Carney's office will be at Columbus, Ohio. Wm. J. Maiden has been appointed assistant superintendent for Ohio, to date from March 1, 1891. Mr. Maiden's office will be at Columbus, Ohio.

* * Fort Wayne's street railway is to be equipped with the Slattery storage battery.

* * A. P. Wilkes has been made superintendent of all the electric lines of St. Paul, Minn.

* * Foreign powers are about to adopt the electric welding method of making shells for artillery.

* * The West End Street Railway Company's central power station, Boston, will be in active operation within a few months.

* * No less than 49 miles of electric street railway lines, owned by five distinct companies, were completed and put in operation in Denver, Colo., last year.

* * The Grand Rapids, Mich., street railway companies have petitioned the common council for permission to abolish the cable and put down the electric car system.

* * The Rapid Transit Railroad Company, of Newark, N. J., has made application to the city for permission to considerably extend its line of electric railroad.

* * A syndicate has purchased all the street car lines in Grand Rapids, Mich., and will discontinue the use of cables for electricity. The entire system extends over 36 miles.

* * The Jamaica, L. I., and Brooklyn Railroad Company may continue the use of overhead electric trolley system, the Board of Railroad Commissioners having announced their approval of the company's application.

* * A contract has been made with the Westinghouse Electric Company to equip the Biddeford & Saco, Me., Street Railroad with electric motor power. Work will begin as soon as possible, the road to be running June 1. The expense of the change will be $30,000.

Obituary.

Thomas Hall, the inventor of a turbine water-wheel, was instantly killed last week by being struck by a train on the Central Railroad of New Jersey, at Raritan. He was 70 years of age.

A Big Breach of Contract Suit.

Chadbourne, Hazelton & Company, the well-known general agents for the United States for the Wenstrom Consolidated Dynamo and Motor Company, of Baltimore, have entered suit against that company in the sum of $200,000, for commissions due and breach of contract.

The Wenstrom Consolidated Dynamo and Motor Company was reorganized over a year ago by a syndicate of wealthy Baltimore capitalists. The capital stock of the company was $1,000,000, and the officers are: E. L. Tunis, president of the company; ex-Governor Groome, vice-president, and ex-Mayor Ferdinand Latrobe, treasurer. The directors are Enoch Pratt, D. D. Mallory, Robert Rennert, Governor Jackson, Ferdinand Latrobe and E. L. Tunis.

This company made a contract with Chadbourne, Hazelton & Company, Philadelphia, to act as their general agents for the United States. The company, it is alleged, only paid in a small amount of capital, and this was expended in building the factory and purchasing real estate.

Chadbourne, Hazelton & Company claim that they have secured a large amount of business and a great many very important and very valuable contracts (some 113 in all), but they have been unable to supply apparatus, and suit is, therefore, brought to recover commissions due on sales that were made, and also for damages for breach of contract.

ELECTRIC CLUBS.

New York Electric Club.

The Death of Mr. T. P. Conant removes one of the best liked members of the Club, for years a member of the Electrical Committee. He was an able electrical engineer, possessed fine literary talents and was highly esteemed by all who knew him. Jos. Howard, Jr., speaks of Mr. Conant in the N. Y. *Press* as follows:

Death has removed from the very limited circle of our very bright young men one who had already attained prominence, and bade fair to reach eminence. Thomas Peters Conant, only son of the late Stillman and Helen S. Conant, and grandson of the Rev. Dr. Thomas Conant, known to the scholarly world as the translator par excellence, died on Tuesday at his mother's home in this city. His father during Thomas' early life was managing editor of the New York *Times*, and subsequently of *Harper's Weekly*. He disappeared one night, it will be remembered, years ago, having last been seen wandering toward the treacherous sands of Coney Island beach. In an atmosphere of literature, for Mrs. Conant has for years been one of *Harper's* most useful aids, young Conant was reared, giving early fruitage of a most delightful and promising nature. He became identified with one of the great electric companies of the country, in the employment of which he died highly esteemed, universally respected, not alone for his talents, which were unusual and his attainments which were varied, but for his high character, self-respecting, honorable.

The Home-Made Dinners given by the Club under the careful and critical eye of Steward Stadler have always been a success.

The Daily Press of this city united unanimously in the opinion that the rapid transit dinner at the Club was a splendid idea. The *Daily Continent* had three columns of illustrated matter about it.

Recent Visitors from Out-of-Town: Henry Smith and Harlow Palmer, Buffalo; Nelson M. Beach, Bridgeport, Conn.; E. G. Bernard, Troy, N. Y.; E. B. Griffing, East Orange, N. J.; Henry Day, Fairfield, N. J.; J. W. Stearns, Jamestown, N. Y.; W. N. Estabrook, Elmira, N. Y.; B. F. Spice and G. T. Crowley, Buffalo; W. C. McIntire, Philadelphia; Geo. H. Meeker, East Orange, N. J.; Frederic Nicholls, Toronto, Canada; F. F. Downes, Denver; Albert J. Corriveau, Montreal; A. A. Dion, Moncton, N. B.; Geo. Titus, Milford, Del.; C. Lee Abell, Buffalo; J. B. O'Hara, Chas. E. Gregory and D. B. Dean, Chicago; A. P. Seymour, Syracuse; W. R. Mason, Chicago.

The Initiation Fee for the next three months will be $10 for associate members and $20 for active members. Every person interested in electricity should promptly make application for membership in this progressive Club.

New York Electrical Society.

The Next Lecture before this Society will be given at Columbia College School of Mines, Friday evening of this week, by Charles E. Emery, Ph. D., the well known engineer, on the subject of "The Utilization of the Forces of Nature."

Providence, R. I., Franklin Society.

A. T. Starkey, of the Edison General Electric Company, of Boston, lectured before the Providence Franklin Society last week on "Electric Power Commercially Considered."

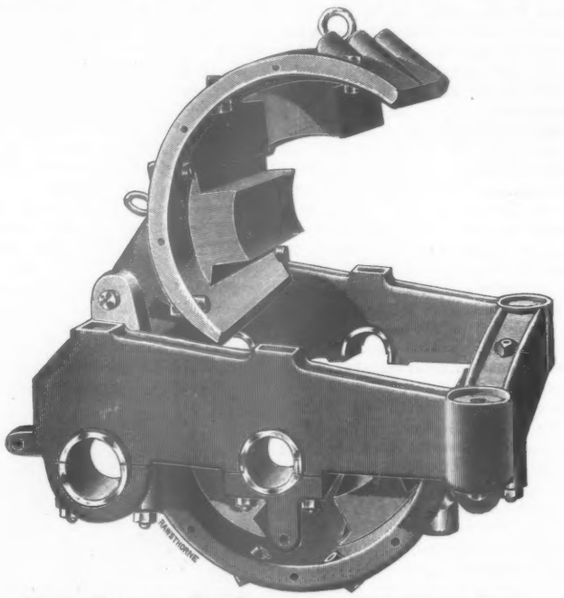

FIG. 1.—FRAME AND SEMI-CYLINDERS OF WESTINGHOUSE MOTOR.

Westinghouse Slow-Speed Motor.

In Fig. 4 is presented a perspective view of the Westinghouse four-pole or single reduction motor, while Fig. 5 shows another view bringing out more prominently the gear casing. The construction of the motor can be more readily comprehended by referring to Fig. 1. Here are shown the castings complete of the motor, consisting of only three parts—the frame and the two semi-cylinders, the two latter being practically one. The size of the frame is such that it can readily be placed upon a bogie truck, being equally as well adapted for an eight-wheel as for a four-wheel car. The width of the motor is such that it can be used on an ordinary three feet six inches gauge, and by slight changes, on a three feet gauge. In the sides of the two semi-cylinders are seen the holes where the plates are secured which serve as a protection to the sides of the machine.

If necessary, the machine can be completely shut in, so as to make it thoroughly iron-clad. It was formerly believed that a motor could not be shut in, since it needed ventilation; but experience with high-speed motors has fully demonstrated that if a motor is correctly designed, electrically and mechanically, and properly constructed, there is no difficulty whatever in enclosing it. At the same time, if in some cases it be deemed advisable to allow a small opening for ventilation, the plates can be constructed accordingly.

The method of enclosing the motor completely is exceedingly convenient in snow and rain storms, and especially where the cars pass over trestles which expose the motor to the full force of the storm. Heretofore considerable trouble has been experienced from water dripping on the motors from the car floor; in this motor, such troubles are completely provided for.

Again, the objections to the motor being exposed to water, dirt and dust, can be fully appreciated when it is remembered that a large number of engineers favor some method of mounting the motors on the car floor. The above objections are overcome by making the motor iron-clad.

Referring to the cut, there will be seen the four internal poles; hence it is what is called a four-pole motor. Some of the claims of four-pole over two-pole machines

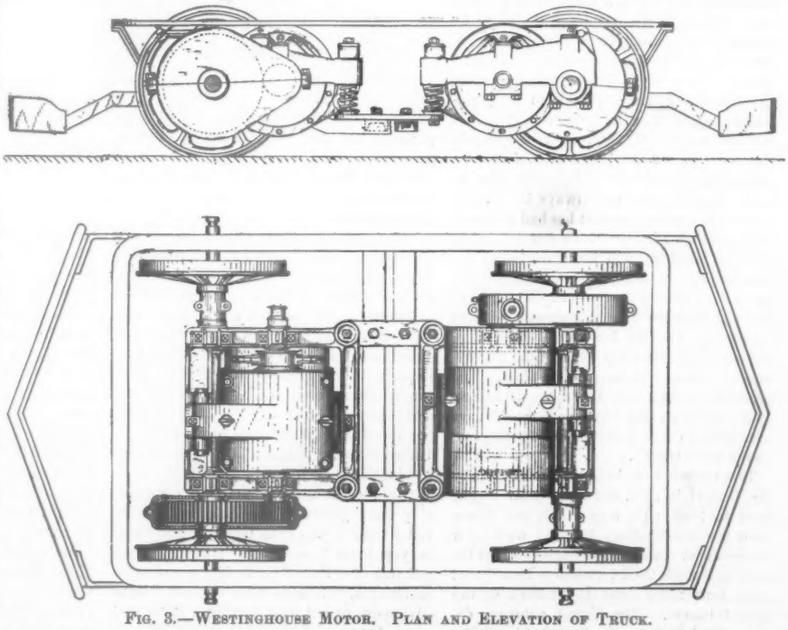

FIG. 3.—WESTINGHOUSE MOTOR. PLAN AND ELEVATION OF TRUCK.

The Southern New England Telephone Company has moved its Hartford office to its new building on Pearl street, in that city.

At the annual meeting of the Lowville Electric Light and Power Company, Lowville, N. Y., the following officers were elected for the ensuing year: President, Geo. D. Jackson; vice-president, M. A. Stoddard; secretary and treasurer, John D. Moore; directors, R. P. Grant, G. M. Skinner, J. L. Bush, W. H. Morrison, John D. Moore, Morgan A. Stoddard, Geo. D. Jackson, F. C. Schraub.

are—slower speed, greater simplicity, better symmetry, and, most important of all, greater radiating surface for the field coils. In case a two-pole motor is used, and the same amount of wire is wound about these two poles, the radiating surface certainly is far less than where there are four poles.

Another important feature to be noticed is the circular form of the motor proper. It is a well known law in mechanics that the strongest form is the arch; consequently,

by this cylindrical form is obtained maximum strength with minimum amount of material. All corners and sharp edges, which mean unnecessary weight, and at the same time have a tendency to reduce the efficiency, are eliminated in this machine.

The fields are completely enclosed and protected, not merely externally by the surrounding cylindrical shell, but also internally by the heavy brass cap covering it completely. There is no liability to accident in case they strike any obstruction in the road, neither can they be injured by gross carelessness in handling.

FIG. 5.—WESTINGHOUSE MOTOR.—VIEW SHOWING GEAR CASING.

The cast-iron frame on which the motor is mounted, also forms a distinguishing feature of the Westinghouse motor. This frame is rectangular in one casting and made especially strong at points subjected to the greatest strains. Special machinery has been devised for boring out holes for the bushings so that the frames, and, in fact, all parts of the motor, are interchangeable. By means of this frame, the armature and car axle are maintained in perfect alignment, and consequently perfect meshing of the gears is obtained, which experience has proved to be of vast importance. The gearing is mounted closely to the frame so as to eliminate the objectionable buckling and tendency to loosen parts. This method gives a strong mounting and perfect rigidity between the parts of the motor. Moreover, by extending this frame completely around the motor, and suspending it at both corners, the strains are distributed and the abnormal wearing of the bearings, so characteristic of single center suspension, is prevented.

In Fig. 2. is shown the method of hinging the field castings. These, as will be noticed, can readily be swung back, thus giving easy access to the fields and armature. The poles protrude radially from the interior of the cylindrical shell. The field coils are slipped over these poles and held in position, and, at the same time, thoroughly protected from the interior by a brass cap. The ease with which the fields are removed or replaced, needs but a glance at the cut to be appreciated. Any field can be removed without disturbing any other part of the motor, and this can be accomplished in little time and with the greatest ease. The lower field can be removed similarly by swinging back the lower semi-cylinder. The armature is then ready to be taken out, and by removing the bushing-cap and placing a sling about the armature, it can be lowered into the pit without obstruction or danger of injuring the armature.

The armature is of the drum type. The core is built up of laminated grooved iron plates so that the completed core has slots to receive the wires. In the completed armature the wires are completely imbedded in iron, hence they cannot be injured from ordinary external causes, since the surface of the armature is iron. The air-space, that is, the distance between the iron and the armature and pole-pieces, is reduced to a minimum, thus greatly increasing the efficiency of the motor.

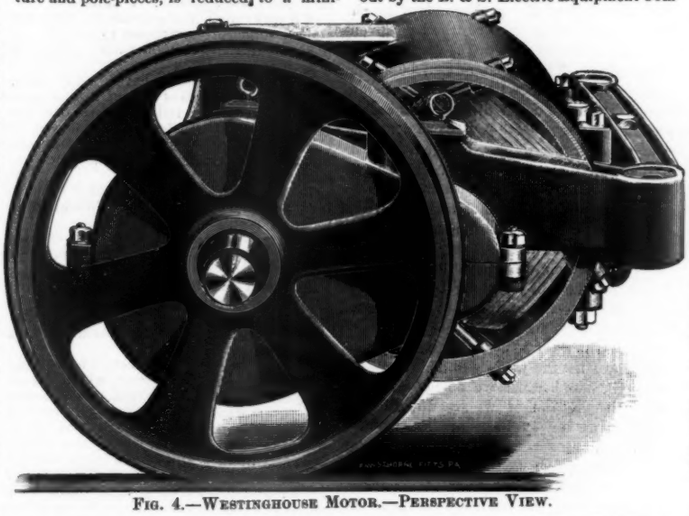

FIG. 4.—WESTINGHOUSE MOTOR.—PERSPECTIVE VIEW.

The armature shaft is manufactured from the best grade of forged steel especially prepared for this purpose. The end of the shaft is tapered to receive the pinion, the holes of which are also tapered so as to fit the shaft perfectly. By this means the pinion always fits the shaft, and, moreover, can be easily removed. This is a source of great annoyance where the old method of mounting the pinion is adopted. The construction of the shaft and armature is such as to make it exceedingly strong and capable of withstanding the severe strains sometimes brought upon it. The oil receptacles are sunk into the frame. The oil boxes are very large, and the method of oiling is the same as that of the high-speed Westinghouse motor. The field coils are wound with wire having exceedingly large carrying capacity, and in winding them, nothing but the best workmanship is tolerated.

The arrangement adopted for the brush-holder has been very neatly worked out. It consists of a square oak holder attached to the side of the frame and carrying the brush-holders proper, which are clamped so that they can readily be adjusted. The carbon brushes are placed in a sliding frame and pressed against the commutator by a pair of springs, which can be released by a pressure of the finger and the carbon slipped out for replacement when worn.

The casting supporting the brush-holder is fastened at the bottom of the motor, so that the brushes rest on the upper part of the commutator, the greater part of which is exposed above so that the commutator can readily be cleaned from the inside as well as from the outside of the car.

FIG. 2.—WESTINGHOUSE MOTOR.—METHOD OF HINGING FIELD CASTINGS.

The B. & S. Ceiling Rosette.

The cuts on page 43 represent a new double pole rosette cut-out recently brought out by the B. & S. Electric Equipment Company, of 115 Broadway, N. Y. This rosette is one of the handsomest on the market, and is simple in the design of its working parts. The body of the rosette is black in color, perfectly resembling ebony or hard rubber, but upon special orders it will be furnished in any color desired. It is made of a fire and water-proof moulded material, which admits of a perfection of finish and accuracy of fitting which cannot be obtained in porcelain. The movable part is heavily ribbed in order to give the wireman a good hold to turn it. The cut-outs are large enough for the largest incandescent lamp as the connecting brasses have two surfaces in contact when the rosette is closed. There are no holes or screw heads showing and the screws for holding it to the ceiling are the only ones that go through the back.

ELECTRIC LIGHT NEWS

—— Keyport, N. J., is to be lighted by electricity paid for by public-spirited citizens.

—— Frankfort, Ind., will open bids, March 30, for lighting the city with electricity.

—— City Engineer Cutshaw, Richmond, Va., is preparing plans for a municipal lighting plant.

—— Medway, Mass., is soon to have an electric light plant. More than $10,000 has already been subscribed.

—— Richmond, Va., has voted $75,000 with which to establish an electric light plant to be operated by the city.

—— It is reported that the Lackawanna officials have decided to light with electricity the long tunnel just outside of Hoboken, N. J.

—— Mr. Frank P. Arbuckle, Highlands, Colo., is going to put in an electric light system, arc and incandescent, and solicits proposals.

—— Maj. W. C. Whitney, of Anderson, is preparing estimates for constructing an electric light plant and water-works in Newberry, N. C.

—— The Hill City Electric Light Company, Vicksburg, Miss., preparatory to extending and improving its service, will float $20,000 worth of 10-year seven per cent. bonds.

—— The butt end of an electric wire contains more terror than the south end of a north-bound plantation mule, and any man who forms an acquaintance with the power is never known to forget it.—*Memphis, Tenn., Commercial.*

—— The South Florida Electric Light Company, of Tampa, has determined to raise its building another story, and is contemplating a belt railroad around the city, to be operated by electricity.

—— Sealed proposals for a system of water works, sewerage and electric lights for Sulphur Springs, Tex. (population 3,500), will be received until April 1, 1891. Write to Mayor W. F. Henderson.

—— At the annual meeting of the Lowell Electric Light Company, Lowell, Mass, the following officers were elected: President, Mayor Geo. W. Fifield; vice-president, W. A. Ingham; treasurer, John H. McAlvin.

—— It seems strange to read that the electric light has been introduced into Jerusalem. The electric plant is used in a large flour-mill adjoining the supposed site of Calvary and close to the Damascus gate.

—— The town of Melrose, Mass., has voted to petition the legislature for the right to manufacture and sell electric and gas light for public and private purposes. Hon. W. E. Barrett, Senator Fernald and L. S. Gould, chairman of the selectmen, were appointed a committee for the purpose of securing the passage of such a law.

—— The new inspector of wires is not receiving the encouragement from the city council that he deserves. If we are to have electric wires under proper control and supervision, the department which has that work in hand ought to be provided with the means. That it has not, at the present time, and the fault is due to the present city council.—*Boston Record.*

—— The deal by which the Laclede Gas Light Company, of St. Louis, acquires control of the Municipal and Missouri Electric Light Companies, cannot be finally closed, it is announced, for at least two months. Terms have been agreed on by the officers of the companies concerned, and everything is practically settled. All that remains to be done to close the deal is to have the stockholders of the concerns ratify the action of their officers. This they will undoubtedly do, though, of course, they have the power to vote otherwise. The delay in closing the deal comes from the fact that the stockholders of the companies have to hold meetings and approve it.

—— Bellevue, O., is to issue bonds for $20,000, to enable it to secure electric lights.

—— The Concord, N. H., Gas and Electric Light Company is about to erect a new central station.

—— In the yard of the Elm street station of the Narragansett Electric Lighting Company is an arc lamp on a mast arm which is the first burned in this vicinity, certainly without wires. Mr. Van A. Thomas, superintendent of the company, has applied the principles of the double trolley electric railway to the hanging of an arc lamp for street service, and is thereby enabled to dispense with the cable, which has always been a source of annoyance. He makes his arms of double angle irons. The irons are used as conductors, and also as a track to carry the lamp over the street. The tracks, with supporting brace, are insulated from the pole, and a switch is placed on the face of the pole to cut the lamp out of circuit while being trimmed.—*Providence Journal.*

RAPID TRANSIT AT THE ELECTRIC CLUB.

(*Continued from page 43.*)

triple compound engines and get down to 15 pounds of water per horse-power, and coal proportionately; while the locomotive will take 24 to 26. But you have first this conversion into electricity in the dynamo and the conversion of electricity into power in the motor—you have a double loss, and if you get 75 per cent. when you get through, you have done well. It will run down, undoubtedly, in the neighborhood of 50 or 60 per cent. when you average up. So that the gain you get by the triple compound engine is lost by the necessity of going through so many operations before you get the power. Now, you are only even. Therefore, it seems there is a chance for electric motors, even on railroads of considerable length. No. You are handicapped again by the necessity of having these electrical conductors, and the farther apart the stations the larger the conducting wires must be, and, therefore, it does not seem feasible. But it does seem that the steam engine directly applied, for roads of considerable length, will hold the lead for a considerable number of years.

Speaking of the plan which seemed to be the best adapted for rapid transit in New York we come back to the necessity of having four tracks on each main line, one on each side of the city. We need the double line for four tracks, and where shall that be put? New York needs more through streets from the lower to the upper part of the city. A plan was thought of to run through Elm street. No matter where it is put that street should be run through. Then when the new street is opened, the excavation could be carried down to the depth required to put in four tracks. In connection with that there should be a surface railway above. That street should be wide enough if practicable to put a wall at each side of two central surface tracks and let the electric cars—for they would be electric cars—run there. You could run the local trains to a greater distance, perhaps a mile, or even three-quarters of a mile might be a better compromise, and then the express stations two or three miles. Then you would have rapid transit.

Unfortunately, gentlemen, you have all to use steam engines as yet. We, therefore, consider that steam is a necessity of the case, but that on account of the losses in small motors, on account of the gases which accumulate in the tunnels, the electric motor has solved the difficulty of running through places where steam cannot go. Therefore, while I quite agree with all here present as to the value of this system, it takes its place only as one of the many means which we have at our command to solve the greater and broader problem. [Applause.]

Mr. Edward Weston said: Mr. President and members of the club—I shall not attack the problem of rapid transit from what I should strictly call the point of view of engineering difficulties, as separated from the electrical difficulties connected with it. I take it for granted that the engineering difficulties can readily be surmounted; that they are not very serious in character outside of the question of cost. Many years ago Brunel designed and constructed the "Great Eastern." You know how much trouble that steamship gave the company which was organized for building it. Considerable litigation sprang up in consequence of those difficulties, and during the litigation Brunel was put upon the witness stand and was considerably annoyed by the questioning of the counsel on the opposite side, who twitted him upon his failure to successfully launch the ship without wrecking the company. One of the lawyers, who was somewhat brighter, apparently, than the rest, asked Mr. Brunel some very sharp questions in regard to the "Great Eastern," and not getting very satisfactory replies, he suggested to Mr. Brunel, "I suppose you would not have any hesitation about building a tunnel from here to China." Brunel instantly replied, "No, sir, I would not hesitate about it one moment if you would not hesitate about raising the money to carry it through." In reality that was the much more difficult problem. That is largely the question in respect to rapid transit. We are located in a city where property values are very high. We must acquire the right of way for the passage of our trains for the accommodation of the public at large. Having acquired the right of way, the problem falls either upon the mechanical engineer who would take up entirely the old mechanical means of transmission, or upon him and upon the electrical engineer. In the latter case the responsibilities would be divided, the mechanical engineer taking care of what may be said to be the mechanical part of the business and the electrical engineer the electrical part. I shall dismiss the mechanical engineering branch, conceding that that can readily be overcome, and consider only the electrical engineering difficulties in the way. Mr. Emery has said that, for the general purposes of carrying of passengers long distances, steam takes the lead. It does today, unquestionably. Does it necessarily follow that it should take the lead, because, at the present moment, we have to depend upon steam for the generation of the energy that we require to propel our electric vehicles? I do not think so. I think there lies a very grave mistake. The steam engine is an exceedingly inefficient means of transforming the energy derivable from the coal into available power or for doing useful work. Therein our hands are tied to a large extent. When it is considered that the best of our steam engines to-day do not yield us over about 20 per cent. of the actual energy of the coal, you can appreciate the unfortunate position of electrical engineers. Looking at the other side of the problem, how much that impresses itself upon us who have given steady attention to the thing is very remarkable, indeed. The dynamo can be made to-day to yield 98 or 99 per cent. of the energy expended upon driving it in actual electrical energy. Of that, 94 or 95 per cent. can, under proper design, be again utilized in the form of electrical energy. That is, it can be delivered out. Now, taking into consideration the extreme difference between the steam engine and the dynamo, and notwithstanding the remarks and publications of many very eminent authorities in regard to the dynamo that the motor is not of the same efficiency as the dynamo, I venture to say that that is entirely a mistake. Whatever the generator will do in the shape of efficiency, that the motor will do. If we do not do it, it is because we do not carefully study the problem or we are unwilling to spend more money to secure the results. But the question as to the efficiency of these two systems, that is, the efficiency of the motor and the efficiency of the generator as compared with the efficiency of the steam engine, is not entirely one of the prime motor. It is another thing. In the locomotive we have to deal with a very different problem from what we have to deal with in the electric motor. In the electric motor the efficiency does not decrease very perceptibly with a reasonable decrease in size of the motor. In the steam engine, on the other hand, it does decrease with a reasonable decrease in size. Small electric motors can be made of nearly the same efficiency as larger ones. Now, such being the case, small motors applied to the axles or with their power diverted to the axles of the cars in such a manner as to eliminate all loss between the motor and the cars, will yield vastly greater results and better results than a single steam engine located at the head of the train. I think Mr. Sprague some years ago considered that question and pointed out the vast superiority of the electric system in efficiency as compared with the steam system, when it was taken into consideration that each car had its unit motor and that the tractive force of the whole train was distributed, in about proportion to the actual load, on the respective parts of the train. The tractive force in the case of a steam locomotive must all be put in the locomotive. We all know how many tons have to be put on a locomotive in order to get that tractive force and how far that may be reduced, and how far the efficiency of the electric system may be made to exceed in general that of the steam system, will be better understood when that question is more thoroughly experimented on and studied than it has been so far. It does not follow by any means that we must have a less efficiency by the intervention of an electric motor. On the contrary, it may be proved, and I think will be proved, that the electrical system will be more efficient than the steam system as generally employed.

In considering the question of what is the best means of rapid transit for a city like New York, we have a number of problems to deal with outside of the question of first efficiency or economy. There must be convenience, quickness of stopping and starting, and every one will concede that the lighter the parts that are to moved, the quicker we can stop and the quicker we can start, the less wear and tear, the less strain on our apparatus and generator. Consequently, the electrical system there should possess an enormous advantage over any steam system, by reason of the very fact that from the lighter loads and the lighter weights you have to carry in proportion to the power developed you could stop and start vastly quicker without injury to the machinery. Then, again, in the electric motor we have something entirely different from what we have in the steam engine. We have no reciprocating parts, but continuous rotary motion. The strains are all tangential, and that ought to aid greatly in running and maintenance. The electric motor of to-day is not what the electric motor of a few years hence will be. To-day we are struggling with difficulties connected with the commutator end of the line, which has been the great bugbear of all systems of electric railroads. Commutators and brushes require more care, outside of gearing connecting the cars, than anything else we have to deal with. They are the weakest spot in the motor and they are the weakest spot in the dynamo. The question arises, can these difficulties be overcome? I think they can. But if they are not overcome, are they not already sufficiently overcome to warrant our placing our reliance upon such a system of transmission?

Well, the railroads we have already built, I think, are a sufficient answer to that question. Much of the railroad work that has been done here has been experimental in character. It must continue to be experimental in character for some time to come.

In connection with the motor, we are laboring under very serious difficulties in regard to regulation.

In the electric motor we cannot do just exactly as we do in the steam—adjust our point of cut-off so as to secure the best results with a given load.

With the steam engine you can do that to a certain extent with a given size of engine.

With the electric motor, unfortunately, we cannot do that at present.

We have to govern our motors by varying the resistance in the circuit, which means loss, necessarily, because that resistance has to be overcome to some extent by the current passing through it or by reducing the intensity of the field magnet, which also means loss; now that is unfortunate; but is it necessary? I think not. The ideal electric motor for the transmission of power would be a motor running at a continuous and uniform speed and with a variable gearing, giving the motor the advantage of power when the car was first started. That we have not exactly reached. You all know that the man in front of the car stands with a regulating device in the cab. When he wants to change the speed of his motor he moves a switch or arm around which adjusts the current flowing through the motor. Now, as a matter-of-fact, the motor should adjust the current itself, and not the man, and the speed of the motor should remain absolutely constant, while for regulation between the motor and the gear on the driving wheels you should depend on varying the mechanical advantage entirely. The need for such a system as we have to deal with here in the city of New York, where enormous amounts of power would be required, are not by any means easily solved. I do not think any direct current system would entirely answer the purpose without a large number of stations and comparatively small units of power.

The difficulties in this respect, however, are not the same as we have to deal with in the transmission of currents of energy for electric lighting purposes. In such a system as is proposed here, the pressure can be largely increased without very great danger or without the limitation imposed by incandescent lamps or other things which we have to deal with, it being mainly a matter of insulation and proper construction of the apparatus. But even under those circumstances, considering that you may lay out a plan or system with great care for insulation, leaving a sufficient margin or factor of safety for all occasions, it does not seem to me very possible or probable that we could do that with a few central stations. We should have to have quite a number unless some system of conversion from high potential to low potential was adopted. During the last few years considerable development has taken place in the art of electric lighting in certain lines, which I may briefly refer to as the alternating current system. That system has extended over a very wide area and has come into quite extensive use and has grown very popular indeed. It is now well understood that that system does not bend itself very well to the transmission of power, that there are great difficulties to be overcome in connection with the motors. The co-efficient of self-induction, or the kick-back, so to speak, of the motors themselves alone interposes a great obstacle to the output per unit of weight. But there is no reason in the world why continuous current converters should not be made vastly to exceed in efficiency the alternating current motors under all conditions of load, which would enable us to distribute currents of enormously high potential over very long lines by means of comparatively small conductors. It seems to me that herein lies the future success of such a system as has been discussed here to-night; that if we expect to reach high speeds and get economical service we cannot hope for a distribution based upon the direct application of the current, but upon some modification of it through a secondary converter by the direct current converter.

As to what can be done here in regard to rapid transit, or anywhere else, under conditions most favorable to it, where the question of first cost in the first plant is sacrificed then I take it for granted that none of us know. It can only be found out by actual test. There is no question about that. That the return will far exceed our most sanguine expectations in that direction, I am sure. With skill, ingenuity and care, there is no question in my mind about the development of rapid transit in this city or any other by means of electricity.

It has been remarked that we have not anything by which we can supplant the steam engine. Well, if we have not we shall have it. A few years ago we had not a telephone, but there were people who believed in the possibilities of it and it has come, and just as sure as you live we shall discover a means of getting rid of this confounded steam engine. It is a nuisance. It requires an immense amount of care, and it is an expensive apparatus to run and very unsatisfactory. Forty years ago, I think, the first experiments were made in connection with getting electrical energy direct from carbon, that is from the combustion of coal, if you choose to put it so. They were successful so far as they went. They were much more successful than many of the efforts that were made up to within a few years in regard to the transmission of speech. The principle is there. It needs to be followed up. I remember when I was a boy making some experiments in that line, my attention was first drawn to it by an experiment described in a little book on scientific subjects written by a somewhat famous man—Professor Pepper—called the "Play-Book of Metals." In that book was first described, so far as I now remember, an experiment in which electrical energy was directly obtained from the oxidation of carbon. The experiment consisted simply in taking a little common saltpetre or nitrate of potash, fusing it in an iron pan and placing in the iron pan, but not in contact with it, a piece of charcoal or carbon. That piece of charcoal was held in position by a platinum wire and that formed one pole of the battery, while the iron formed the other pole. Under those circumstances the carbon was much more rapidly oxidized than the iron, and as a result of it an electric current was produced. About 10 or 15 years ago that experiment was revived and announced as a grand discovery. Now, it having been proved that carbon can be oxidized in that manner, and that carbon can be oxidized also without the application of heat, it does not seem to require very much to carry us further along to producing the thing itself. Whatever is done in that direction will come right into play in connection with the future rapid transit system of New York and the world. [Applause.]

After passing a vote of thanks to the speakers of the evening, the club adjourned.

Electric Cars and the Texas Press.

Never in the history of Austin were the nighthawks so thoroughly startled as they were about two o'clock this morning when one of Col. Shipe's electric cars came tearing down the avenue, the wheels screeching on the new rails like a conclave of catamounts, and electric sparks filling the air in all directions. In front of the *Statesman* office the jinglefluke failed to work and the car stopped. While fixing the apparatus, Col. Shipe was heard to sollicquize thusly: "The *Statesman's* gone to press. I've got 'em this time. If the people wake up in the morning and find the cars running they'll cuss the *Statesman* and praise Shipe. If it had announced that we would be running to-morrow, and this durned jinglefluke didn't work, then they would cuss Shipe—and cuss the *Statesman*, too, I reckon." But the Colonel was mistaken. The *Statesman* had not gone to press, and if the cars are not running this morning the Colonel must take the medicine he has prescribed for himself. The *Statesman* can stand its dose—it's our regular diet.—*Austin, Tex., Statesman.*

PERSONAL.

Samuel H. Taylor, of the California Electrical Works, San Francisco, was a welcome caller at the REVIEW office last week.

Mr. D. W. Baker, of Newark, N. J., the head of the platinum house of Baker & Company, left Saturday, February 28, on an extended trip through Mexico, accompanied by Mrs. Baker.

Col. W. P. Canaday, ex-sergeant-at-arms of the Senate, who is now practising law in Washington, D. C., has been offered a lucrative position as representative of an electrical company of the United States in China.

C. A. Smith, who has been connected with the New Haven Copper Company's plant, will sever his connection with the company on March 8, and will go to Nicaragua and put up the new electric lights along the Panama canal.

Mr. Charles W. Baker, of Baker & Company, Newark, was married Wednesday, February 25, to Miss Larenia M. Parsons, also of Newark. Mr. Baker is a brother of Mr. Cyrus O. Baker, Jr., widely known in electrical circles.

Mr. M. D. Law, who was for many years superintendent of the electric light company of Philadelphia, and more recently at Denver, has decided to come East again, and will take charge of the arc lamp department of the Edison Machine Works, at Schenectady, N. Y. Mr. Law is an able and progressive electric light man and will be a valuable addition to the staff of the Edison Company.

Mr. W. H. Dyer, of Pawtucket, R. I., who for the past 12 years has been engaged in the leather belting business, has recently accepted a position with the widely known Shultz Belting Company, of St. Louis, and will travel for that company and make a specialty of their woven belts for electric lighting and power companies. Mr. Dyer is an experienced and valuable man, and will do good work for the Shultz Company.

Baxter Electric Railway System.

A short time ago an experimental trial of a new Baxter street railway motor was described in the REVIEW. The Baxter Electric Motor Company, Baltimore, owners of the patents on this system, have since worked out all details, and are now in the field prepared to fill railway contracts.

In Fig. 1 is shown a 100 horse-power Baxter electric railway generator. It is multipolar and wound for 500 volts. A separate exciter is used to keep the potential constant, regardless of load. The armature is of the Gramme ring design, permitting slow speed and preventing the wear and tear incident to high speed armatures. The brush-holders are so designed that the brushes are automatically "fed in" with a light and constant pressure which ensures long life to the commutator and eliminates all sparking. A special feature of this generator is the mounting of the pulley between the bearings, thereby relieving the machine from all torsional strain and giving it great stability.

The bearings are self-oiling, and are provided with oil wells which prevent all waste of oil and ensure perfect and automatic lubrication. These generators are mounted upon very heavy bed-plates and so equipped with guides and check-nuts that all possibility of the slightest displacement under any strain is prevented, and vibration is reduced to a minimum. They are built in different sizes, from 50 horse-power up, to meet the demands of local conditions.

In the latest type of Baxter motor, the armature speed is reduced to 420 revolutions per minute when the car is running at a speed of ten miles per hour. To absolutely prevent any binding in the bearings while taking curves, the motors are suspended upon a universal joint. Owing to the compactness of the motors, ample space is left in the wheel base for a frame-work or cradle spring supported from the truck, which carries the resistance box, and to which the motor suspension is attached. This construction eliminates unpleasant jarring of the car body, and allows of all wires (excepting those for lighting purposes) being carried independent of the car body. This obviates all necessity of loose wire connections between the car body and the motors, which renders it much easier to separate the two; in fact, when the car body is raised the entire electrical equipment of the car remains on the truck. The advantages of this arrangement for repair work and in changing

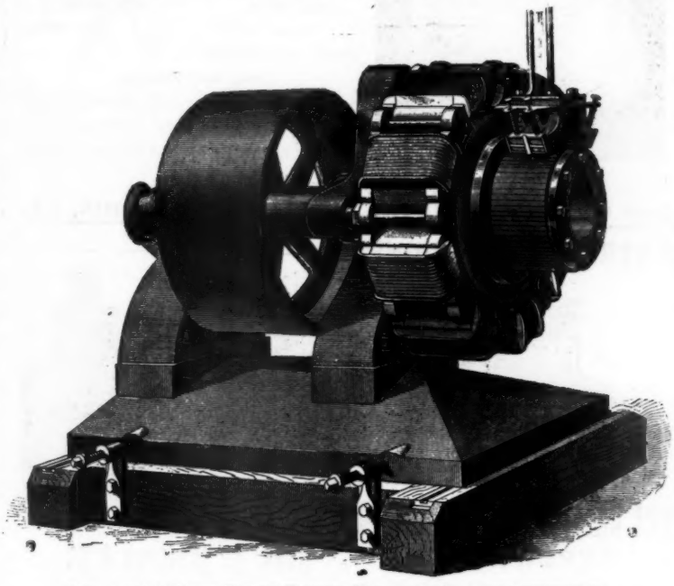

FIG. 1.—100 HORSE-POWER BAXTER ELECTRIC RAILWAY GENERATOR.

from open to closed cars are obvious. An important feature is the ample clearance (*i. e.*, six inches) between the lowest part of the machinery and the pavement.

Fig. 3 shows the truck in plan and elevation. The bridge truss method of construction is followed, giving the greatest strength for the weight. Access to all parts of the machines is easy, and the removal of the motors can be effected in a very short time. The length of the supports is calculated to reduce rocking of the car body to a minimum. It affords the motors a spring support and permits a yielding impact of the motors on the load at starting.

A perspective view of the truck, equipped with two 15 horse-power Baxter motors, is shown in Fig. 2.

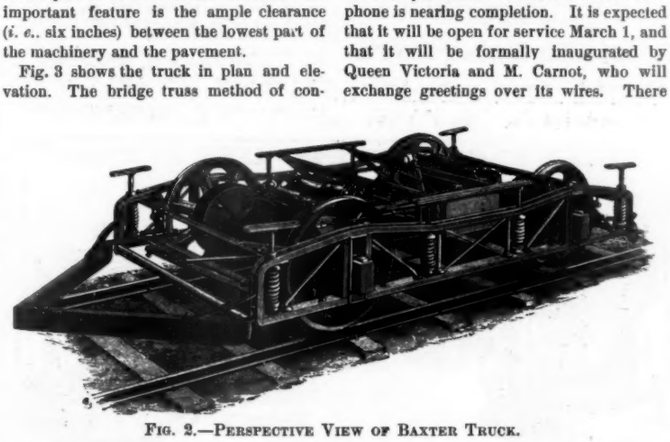

FIG. 2.—PERSPECTIVE VIEW OF BAXTER TRUCK.

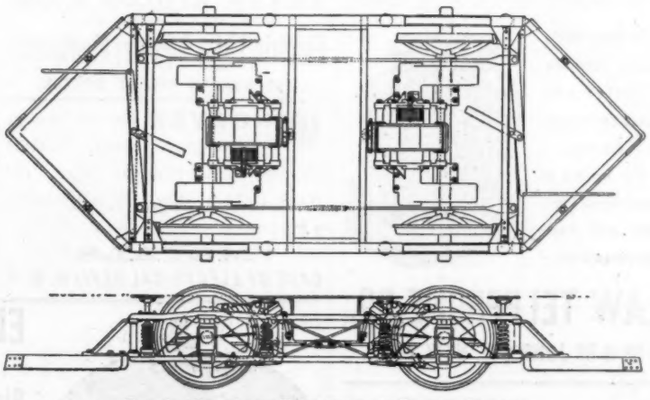

FIG. 3.—PLAN AND ELEVATION OF BAXTER TRUCK.

Foreign Telephone News.

The National Telephone Company, Limited, of London, in six months, ending December 31, 1890, earned a net profit of £108,170 19*s.* 11*d.* The capital April 30, 1890, was £2,204,000. With a reduced tariff it is getting new subscribers at the rate of about 75 per week. The London-Paris telephone is nearing completion. It is expected that it will be open for service March 1, and that it will be formally inaugurated by Queen Victoria and M. Carnot, who will exchange greetings over its wires. There will then be telephone connection between the London Stock Exchange and the Paris Bourse. The tariff has been placed at 10 francs for three minutes' use of the telephones.

There are now 120 women in the Berlin telephone exchanges. It has been decided to use only women in the future, as it has been found that their voices are much more audible than men's owing to the higher pitch.

TELEGRAPHIC

.... An approximate estimate of Jay Gould's holding of Western Union stock is 230,000 shares.

.... Mr. Gould has denied that any basis existed for report that the Western Union would increase its dividend rate to six per cent.

.... The Postal Telegraph Company has discharged 80 linemen and diggers at work between Pittsburgh and Altoona because of scarcity of work.

.... Mr. Bellamy, in his *New Nation*, charges that congressmen all have telegraph frank-books, and it is due to the influence of this bribe that the postal telegraph bill was killed.

.... The Western Union Telegraph Company is taking up the line on the highway between St. Paul and Chicago, purchased some years ago of the Mutual Union, and transferring it to the railway.

.... The Adirondack Telegraph and Telephone Company has elected the following directors for the ensuing year: J. W. Burdict, C. H. Erwin, W. C. Humstone, W. F. Weston and H. L. Waterbury.

.... The police telegraph system at Wilmington, Del., is discovered to be in a thoroughly disorganized condition. It will take two or three weeks to get it in order again. The officer in charge has been placed back on the regular force.

.... E. R. Adams, superintendent of the telegraph lines of the Philadelphia & Reading Railroad Company, has been authorized to rebuild some 87 miles of the company's lines this year with new poles, and for the most part with heavy copper wires and at a cost of upwards of $26,000.

.... Morris W. Mead, superintendent of the Pittsburgh bureau of electricity, has submitted his annual report. The report is exhaustive, giving a description of the work done during the past year, and contains several recommendations designed to still further improve the service.

.... The old University building, on Washington square, New York, is of interest to all telegraphers. It was here that Professor Morse, 54 years ago, put into practical operation the first telegraph ever set up in the world, and it was on the third floor, in the north wing, that the wires over which the first message was transmitted were raised.

.... The Court of Appeals has affirmed the judgment in the action of the American Rapid Telegraph Company against Jacob Hess and others, which is in favor of Hess. The chief object of the action was to restrain the defendant from cutting down its telegraph poles. This evidently confirms the constitutionality of the law compelling the putting of wires underground in New York city.

.... The Western Union Telegraph Company have leased the old Assembly building, at the southwest corner of Tenth and Chestnut streets, Philadelphia. Work will be begun at once looking toward the transformation of the old building into one of the most complete telegraph offices in the United States. The plans are now being prepared under the general direction of William B. Gill, the general superintendent of this district. They comprise a most complete system of pneumatic tubing, steam heating, electric work and gas fitting. By far the most important innovation will be the introduction of pneumatic tubes to newspaper offices. The present force of operators in the offices are to be dispensed with, and dispatches sent out from the main office through tubes. It is expected that the work contemplated will be finished in about two months.

KINDRED INTERESTS

The Detroit Electrical Works, Detroit, Mich., have issued a handsome catalogue describing the Rae electric railway system.

The New Building erected for the National Pipe Bending Company, New Haven, Conn., has been completed and the machinery will be in running order about March 15.

The Baxter Electric Motor Company, Baltimore, Md., are sending out a handsome catalogue describing their electric street railway system. Illustrations are profuse and reading matter complete.

The Walworth Manufacturing Company, Boston, is erecting a building 36x136 feet at Pittsburgh, Pa., near the Keystone Rolling Mill, where it will continue the manufacture of metallic poles for supporting telephone and other wires.

The Central Electric Company, Chicago, report unprecedentedly large sales of Okonite and improved Candee wires. From the nature of the orders received during the month of February, the indications are that a very large amount of high class construction will be done as soon as the Spring opens.

The Tropical American Telephone Company, New York and Boston, has just received the following from St. Kitts, West Indies, where the telephone system is operated by the colonial government: "Exceedingly pleased with your new Williams standard switchboard. It is a decided improvement."

The Weatherproof Rubber Tubing made by the Electrical Supply Company, of Chicago, is found very desirable in the many cases where a flexible wire protector is required. The soft rubber tubing has a double weather-proofed braided covering, which will stand abrasion and prevents rotting of the rubber.

The Crocker-Wheeler Electric Motor Company, New York, has secured as sales agent Mr. George W. La Rue, whose long and successful connection with the Sprague Electric Railway and Motor Company as agent in the East, is sufficient guarantee that the Crocker-Wheeler perfected motors will be found at the head of the procession.

The Stanley Electric Manufacturing Company, Pittsfield, Mass., is fitting up a new factory in the Morton building. Machinery is being rapidly placed in position, and the making of the Stanley converters, to which the concern will devote itself, will soon be in progress. A 10 horse power dynamo has been added for power. J. H. Kelman, who has been in Pittsfield for the past three months, will be superintendent of the new factory. He has taken possession of his office. Henry Hine, the new general manager of the concern, began his duties in that capacity last week.

The Union Electric Manufacturing Company, of Bridgeport, Conn., was represented at the recent Convention of the National Electric Light Association by Mr. J. M. Orford, the genial president of the company. No exhibition of the company's electrical specialties could be conveniently made at Union Hall as all available space had been taken previous to Mr. Orford's arrival. This, however, did not prevent the Union electric switch being made known to all the electric light people who were present at the Convention. The merits and peculiar features of the switch were heartily appreciated and favorably commented on.

Holmes, Booth & Haydens, Waterbury, Conn., have recently added to their manufacturing plant a new mill for rolling hot copper rods. It is of brick, 100x150, one story high, the power being furnished by 450 horse-power engines and three upright Corliss boilers, all of the Providence make. The mill is now in full running order. They have also added other facilities for copper wire drawing, together with much new and improved machinery for their general lines of manufacture. Another important addition is a complete plant for the production of seamless brass and copper tubing of all sizes. The building for the new department is of brick, 60x120 and two stories in height.

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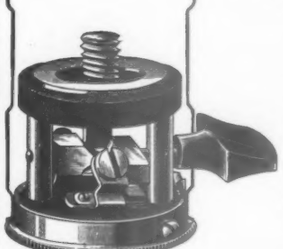
Two 30-Inch Three-Ply Perforated Electric Belts for GAUTIER STEEL DEPT., JOHNSTOWN, PA.

"BRYANT SOCKETS."



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ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENTS OF THE UNITED STATES WERE ISSUED ON FEBRUARY 17, 1891.

446,666 System of electric lighting. 446,668 Electric arc light. 446,669 Manufacture of filaments for incandescent electric lamps; Thos. A. Edison, Menlo Park, N. J., assignor to the Edison Electric Light Co., New York, N. Y.
446,667 Locomotive for electric railways; Thos. A. Edison, Menlo Park, N. J.
446,684 Electric music box; Chas. A. Hussey, New York, N. Y., assignor to M. J. Paillard & Co., same place.
446,708 Electric fire engine; Mark W. Dewey, Syracuse, N. Y., assignor to the Dewey Corporation, same place.
446,730 Induction coil; Fred. H. Brown, Chicago, Ill.
446,732 System of electric calls; Jacob B. Currier and David H. Rice, Lowell, Mass.
446,767 Magnetic ore separator; Chas. G. Buchanan, New York, N. Y.
446,801 Electric regulating clock; Désiré Van de Plancke and Gustave Van de Plancke, Courtrai, Belgium.
446,817 Electrically propelled car; Rudolph M. Hunter, Philadelphia, Pa.
446,821 Electric locomotive; Eben M. Boynton, West Newbury, Mass.
446,826 Detachable ceiling block or bracket for electric lamps; Herbert C. Wirt, Boston, Mass., assignor of one-half to James L. Kimball, same place.
446,831 Electric heater; Thos. J. Donovan, Chicago, Ill., assignor to Walter G. Goodrich, same place.
446,833 446,884 Electric railway; Rudolph M. Hunter, Philadelphia, Pa., assignor, by mesne assignments, to the Thomson-Houston Electric Co., Boston, Mass.

ISSUED FEBRUARY 24, 1891.

446,846 Thermostat; Adolph M. Barron, Kansas City, Mo.
446,861 Underground railway conduit; Chas. C. Gilman, Eldora, Ia.
446,864 Electric motor; Ludwig Gutmann, Pittsburgh, Pa.
446,902 Automatic cut-out; Jacob P. Tirrell, Boston, Mass., assignor to Horace A. Pinkham, Philadelphia, Pa.
446,917 Electric railway signal; Earl T. Harvey, Chicago, Ill.

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